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HEARINGS

BEFORE

SUBCOMMITTEE NO. 5

OF THE

SELECT COMMITTEE ON SMALL BUSINESS

HOUSE OF REPRESENTATIVES

EIGHTY-FOURTH CONGRESS

SECOND SESSION

PURSUANT TO

H. Res. 114

A RESOLUTION CREATING A SELECT COMMITTEE TO CONDUCT A STUDY AND INVESTIGATION OF THE PROBLEMS OF SMALL BUSINESS

MAY 18 and 19, 1956, LOS ANGELES, CALIFORNIA

Part VII

AIR POLLUTION PROBLEMS

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AIR POLLUTION PROBLEMS

FRIDAY, MAY 18, 1956

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE NO. 5 OF THE COMMITTEE
TO CONDUCT A STUDY AND INVESTIGATION OF SMALL BUSINESS,
Los Angeles, Calif.

The subcommittee met, pursuant to call, at 10 a. m., in courtroom No. 9, United States Post Office and Courthouse Building, Los Angeles, Calif., Hon. James Roosevelt (chairman of the subcommittee) presiding.

Present: Representatives Roosevelt and Sheehan.

Also present: Warren H. Biscailuz, subcommittee counsel; Katherine C. Blackburn, staff member; and S. V. O. Prichard, subcommittee special consultant counsel.

Mr. ROOSEVELT. Will this hearing come to order, please.

Before we begin this morning, I should like to state the ground rules.

The members of the press are, of course, very welcome and also the photographers that are present. However, the House has rules and regulations which prohibit the taking of any pictures during the course of the hearings itself. If the members of the press want to take a picture of a witness, if they will so indicate to the Chair prior to the beginning of the witness' testimony, we will suspend for a minute or so to allow the picture to be taken prior to the witness beginning his testimony.

I also want to make an announcement with regard to the subcommitee. Hon. Timothy Sheehan is present with me this morning. The third member of the subcommittee, Hon. Tom Steed, of Oklahoma, will join us tomorrow morning.

Mr. Prichard is here with us this morning as special counsel to the subcommittee. On behalf of the subcommittee, we want to express to him our very great appreciation for the time and effort which he has given us in helping to organize this hearing. I have a preliminary statement here which I will read, copies of which will then be available to the press.

This subcommittee of the House Small Business Committee is commencing hearings today with the primary purpose of hearing testimony and receiving other evidence to the effect that the lack of Federal assistance in smog control has made the smog situation particularly acute for small-business concerns in the Los Angeles area.

The committee has received many complaints from small-business men regarding the harmful economic effects of smog on their businesses and asking if there are any means by which the Federal Government can take more effective action.

I want to emphasize at that point that this committee is very well aware of the fact that the primary responsibility regarding smog is on a local level and that the Federal Government has only a contributory responsibility to the efforts of local authorities.

Small businesses and air-pollution-control officials in Los Angeles have also complained that small-business concerns, shut down during smog alerts in Los Angeles, do not have the capacity of the larger firms to make up production on subsequent schedules.

In connection with this subject, I would like to read at this time the following letter addressed to me by Mr. S. Smith Griswold, air pollution control officer for the air pollution control district, county of Los Angeles:

DEAR CONGRESSMAN ROOSEVELT: I am transmitting herewith for your consideration a copy of the district's request to the Federal Government for a financial allocation to be devoted to air-pollution research of national interest. Attached also is a copy of a resolution adopted by the board of supervisors at their Tuesday meeting.

As you may recall, the Department of Health, Education, and Welfare had originally requested an appropriation of $3 million to finance the Federal air-pollution research program for the next fiscal year. Upon an examination of that program, however, we felt that an increased appropriation should be sought in order to finance several projects necessary to the resolution of our own smog problem, but which were of national rather than of purely local significance. We, therefore, had several discussions with Federal officials and with the Los Angeles County delegation in Congress.

As a result of these discussions, a comprehensive conference between representatives of the Federal Government, the State of California, and local public and private air-pollution research agencies in California was held at Berkeley last month. Resulting from that conference was a request that the air-pollution control district submit details on several research projects which the conference had concluded should properly be performed by the Federal Government. This list of projects, requiring expenditures of more than $700,000 was prepared and forwarded to Dr. Malcolm Merrill on March 1, 1956, for his transmittal to the Federal Government.

Since submitting this letter, however, Senator Thomas Kuchel has informed us that the House of Representatives has given passage to the Federal air-pollution appropriation bill and has cut the originally requested amount of $3 million by $260,000. Since the original request of $3 million was considered inadequate, the present allowance, after the House cut, will fall short by about $1 million of being a sufficient amount to carry on the most important and urgent research projects.

In view of these factors, I felt that you would like to be informed of this situation and that you might wish to take such corrective action as is required in Congress in order to increase the Federal appropriations for the next fiscal year.

I cannot emphasize too strongly our belief that the taxpayers of California and of Los Angeles County should not be expected to bear the full financial responsibility for projects which are more properly of national interest and importance.

Certified copies of the resolutions adopted by the Los Angeles County Board of Supervisors, the City Council of the City of Long Beach and the City Council of the City of Gardena have also been received by the committee. These resolutions urgently request the United States Government, through the Department of Health, Education, and Welfare to augment appropirations of the Federal Air Pollution Agency, established under the United States Public Health Service, and to restore such original amount of $3 million and $705,000 in addition thereto, in order to accelerate research in the field of air pollution, so that the health and welfare of the citizens of all metropolitan areas may be benefited.

As a result of the foregoing information and complaints and as chairman of the subcommittee of the House Select Committee on Small Business, I conferred with the Hon. J. Percy Priest, chairman of the House Committee on Interstate and Foreign Commerce, who is in full accord and agreement with the members of the subcommittee that the air pollution or smog hearings in Los Angeles will be very helpful to his committee in determining what remedial Federal legislation will be most effective to combat the serious air pollution problems in Los Angeles and other cities throughout the Nation.

This subcommittee will act solely as a factfinding body which hopes to attain a true picture of the smog problem in Los Angeles, its effect on small-business enterprises and means by which the Federal Government can take more direct action either by increased appropriations or other legislation.

The subcommittee hopes that it will secure sufficient information as a result of these hearings to submit constructive recommendations for remedial Federal legislation to the House Committee on Interstate and Foreign Commerce for its consideration and action.

Now, I would also like to state that the committee has received a great many requests to be heard and within the limited time available unfortunately it is not possible to hear all of the witnesses.

This morning's session will last until about 12 or 12:15—and we will then recess for lunch and reconvene at 1:30, and we will sit this afternoon until aproximately 4:30 or 5. Then, tomorrow morning, we will meet again at 9:30 and we will recess again about noon, come back at 1:30 and hold an afternoon session.

Parenthetically, I might say that Congressmen work on Saturdays.

It is my understanding we will meet in this same room tomorrow. If there is any change by the end of the day, we will announce it.

I want to say that any person who has not been scheduled to appear before the committee and who would like to submit a statement for the consideration of the committee, may do so. I will call for those who are present who would care to come forward and submit written statements or documents, before we recess each session—the individual sessions. After identification by the individual coming forward, the documents will be accepted for the records of the committee.

Now, the first witness who will be heard this morning is Mr. Harry Bloch, representing the Amalgamated Clothing Workers of America.

Mr. Bloch is now in the witness chair and I will swear him, which we will do with each of the individual witnesses as they come forward.

Mr. Bloch, will you rise, please, and raise you right hand.

Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. BLOCH. I do.

TESTIMONY OF HARRY BLOCH, REPRESENTATIVE OF AMALGAMATED CLOTHING WORKERS, LOS ANGELES, CALIF.

Mr. ROOSEVELT. Mr. Bloch, our normal procedure is to allow you to proceed in your own way and to tell us what you want to tell us, and then, members of the committee and the counsel will perhaps ask you questions at the conclusion of your testimony.

Mr. BLOCH. I am here representing the clothing industry.

Mr. ROOSEVELT. Would you first please identify yourself. Will you please give your full name and address to the reporter?

Mr. BLOCH. Harry Bloch, 2501 South Hill Street, Amalgamated Clothing Workers of America. I am here representing approximately 20,000 needleworkers in the area and 7,000 of the Amalgamated Clothing Workers, an industry in which people's livelihoods depend mainly on their eyesight.

It is an industry where we have women who sit daily at a bench for 8 hours sewing, hand sewing, with fine needles. We have operators who sit at machines, at power machines, who have to depend on their eyesight.

We have operators in the cutting rooms who operate power cutting machines, which are very hazardous. Any slip or any blinking of an eye sometimes can cause the loss of a finger or hand.

Under these conditions, we approach our place of work in the morning and actually, you could see it this morning. By the time you get halfway down to the office or shop, your eyes are smarting from the smog, and it affects the efficiency on the job.

We have had instances where shops have had to close down. There is no chance of making it up, because what you lose today, you just don't make up. We have had some factories who couldn't afford to close, because it might mean the cancellation of the small order, which they depend on. These people were forced to work under conditions that, as I said before, are hazardous.

We would like to abolish this sort of condition, not only for the manufacturers but for the general health and welfare of our membership.

There is another aspect to this that affects the clothing workers. We in the past 15 years are endeavoring to establish a clothing market on the west coast. With the increase of the population, we feel that this would be a good medium to provide jobs and there is a tremendous market in the Western States and Southwestern States for our product.

This discourages eastern manufacturers who would be able to establish an industry here, the manufacturers that have the financial backing, and as a result, every time they visit here and especially at times when there is a smog condition, this is a detriment. This will discourage them and, too, it is forcing some of our industries to move out of the city and out of the area where the smog is affecting the industry.

We would like to keep the industry localized, because when they spread out this way, it is not good for the industry. Therefore, we have shops moving out into suburban areas and rural areas where farm people and people in the rural areas find employment.

We would rather keep the industry localized where the population is the greatest and where the need for industry is more important, and we feel that because of this smog condition, it is not conducive to health or to prosperity in this area.

Mr. ROOSEVELT. Thank you, Mr. Bloch.

May I first ask you whether I am correct in assuming that most of the manufacturers employing the people you represent would properly be classified as small businesses?

Mr. BLOCH. That is right. I can qualify that by saying that any number of plants in the East, just to mention Bond's, employs more

people than the entire State of California in the clothing industry, but we have more shops, individual shops.

These 7,000 people are spread out, say, from San Diego up to Taft.

Now, the reason that they have gone these distances is to get away from this condition here, and we would like to put a stop to that and keep our industry where we have the most people and where the need for jobs is greater.

Mr. ROOSEVELT. Mr. Bloch, I am sure that you recognize that the problem of air pollution is primarily a local responsibility, as far as the enforcement measures are concerned, as far as strictly remedial steps are concerned.

Is it your thought, as I gather from your testimony, that the contribution of the Federal Government should be in the field of research as to what the ingredients are that produce an eye irritant that it makes it particularly difficult for the people in your industry to work?

Mr. BLOCH. Yes; I would say that after the years of experimenting here on a local level with the wrangling between the various local agencies as to the competency of the smog czar, so-called, and one such person wasn't doing a job and they voted him out and voted in another, and we have heard of the various devices that have been suggested, to put a stop to this smog. You see automobiles roaming the streets with "Smog Air Pollution Committee" on it, exuding gas fumes just like my automobile.

They tell us we should have a device on our automobile exhaust pipes and I understand they are very costly. It is an estimate of somewhere around $300 to attach one of these.

Of course, I think they primarily meant that for the trucking industry.

Then we hear and read of the suggestions and recommendations of the devices on the smokestacks or the boilers of the oil refineries and the heavier industries, and this is about as far as it goes, as far as we are concerned.

We still have the smog. We haven't had any indication that there is anything in the offing that would definitely put an end to it. We are told on the one hand that it is caused by big industry. Big industry, at a hearing some time ago, put the blame on backyard incinerators.

Now, that hearing, if I may just repeat—on the day of the hearing, the outlying districts, Beverly Hills and Hollywood, were clear of smog and as you approached the downtown area, the air was blue like today.

Suffice to say that every backyard practically in Hollywood or in the residential area has an incinerator and Sunday there is no restriction on burning and the downtown area, where there are no backyard incinerators, was blue with smog.

This I thought was an indication that would dispel the theory that it is caused by backyard incinerators.

Now, we in our industry have been petitioning and I think, Mr. Roosevelt, you have received the petition from our organization, as has every member of the city council, every member of the board of supervisors, the mayor and the governor; and we feel it is about time that some attention should be paid to these petitions and requests and resolutions that affect the lives and the welfare of so many people, and, as I said before, so far, we haven't seen any or heard of any indication that would cure this situation, and I feel that the Federal

Government should intervene here and have an investigation of some sort and find out whether this thing is being used as a political football or whether it is being used for somebody's financial gain or if we are lacking the material in the research department.

The Government could put in a committee here or a research person or committee and probably get down to some of the true facts.

I understand that they had such a situation in Pittsburgh, and now we hear of Pittsburgh being cleared up, and that there is no more of that black smoke, the pall over the city. I am sure that Los Angeles is entitled to like treatment.

Mr. ROOSEVELT. Of course, Mr. Bloch, I should point out that Pittsburgh's situation was largely cleared up through the program initiated and controlled by local authorities, and I would hesitate to say that this committee is going to recommend that we come in and force local authorities to perform what is their responsibility.

However, we are anxious to find out how we can help local authorities and we will hear, during the course of the hearing, from them.

Primarily, however, I am interested in your testimony because I think I am correct in saying that the products of your labor are distributed in interstate commerce——

Mr. BLOCH. That is right.

Mr. ROOSEVELT. And as such, the Congress has a responsibility to see to it that your efforts and your labor, the results of your labor, are not hindered in free exchange through interstate commerce.

Therefore, we think that your testimony is pertinent—particularly along the lines of research—and if we can point up the fact that local responsibility is not being properly exercised, of course, we shall be very happy to do so as we go along.

Mr. BLOCH. All I had in mind was bringing in the Federal Government. I know the people here are capable of doing the job. I want to find out why they are not doing it, and maybe the Federal Government can come in and show us why.

Mr. ROOSEVELT. I just have one other statement I want to make.

The resolution to which you referred will be made a part of the record at this point in the record, and if it is agreeable to you, I will have it marked as submitted from you at this point for the record.

Mr. BLOCH. I would be happy to have it submitted.

(The information referred to follows:)

RESOLUTION ON THE EFFECTS OF SMOG ON THE MEN'S CLOTHING AND ALLIED INDUSTRIES

During the recent series of smog crises a number of men's clothing and shirt plants located in the industrial district were forced to close;

The closing of plants in a piecework industry causes serious financial burdens to workers employed in such industries;

Needle trades workers are dependent on good use of vision whether they do hand or machine operations;

The smog problem impedes the use of vision;

The growing severity of smog could tend to force the expanding men's clothing and allied industries in Los Angeles to leave this city: Therefore, be it

Resolved, That the Los Angeles Joint Board of the Amalgamated Clothing Workers of America inform Gov. Goodwin J. Knight, Mayor Norris Poulson, members of the city council and board of supervisors of the specific dangers of smog to our industry and its workers; and be it further

Resolved, That we urge our city officers to organize a united and all-out attack on the smog problem.

Mr. ROOSEVELT. Mr. Sheehan, do you have some questions?

Mr. SHEEHAN. Yes, Mr. Chairman.

Mr. Bloch, like Mr. Roosevelt, I think we both believe in Abraham Lincoln's precepts that the Federal Government should do only what the local governments can't do for themselves and until such time as we know or feel that the local governments haven't done a complete job, we would be very reluctant to even interfere here.

With that thought in mind, I was just wondering whether or not the employers in your particular industry as a trade association or as a group, have attempted to do anything through a united action to help in the cause.

Mr. BLOCH. No. As far as I know, they have not. They, of course, rely on the unions to take up this matter and this has been done before.

These small manufacturers here are not as well organized as other markets where they have the manufacturers association. They have here various associations in certain parts of the industry, but I am sure they have not taken the matter up, or they may have been represented here.

Mr. SHEEHAN. I do know from my personal experience in many parts of the country that when a problem affects an industry, whatever affects the employers affects your membership, and I do know in other sections of the coutry where a mutual problem would be met by the union and the employers working together, either each contributing funds or contributing effort and initiative to see whether or not they could do anything to alleviate the problem.

Has there been any thought of your union and the employers getting together and contributing any money equally, or something like that, to fight the problem?

Mr. BLOCH. No. There was discussion. There was no plan. There was no agreement as to what we were to do jointly and as evidence of that, they have not sent a representative to this hearing.

That is only because their association is not as closely knit a group as they are in other clothing markets.

Mr. SHEEHAN. In other words, neither from the employer's angle—I am speaking only of your own trade group—nor from your own union angle, has anything been done in those two particular groups such as contributing money, conducting research or anything else to find a solution?

Mr. BLOCH. Nothing but what we as the union are doing. The employer hasn't, as far as I know, indicated any willingness to underwrite funds or to have representatives take this matter up.

Mr. SHEEHAN. Well, do you think there is any sense for you people as unions, in order to protect your union membership, to call the employers together and maybe get some sort of joint effort, because this is going to be a local effort in the final analysis?

Mr. BLOCH. I sure do. Certainly there can be no harm in that, and I think it would help, because there are manufacturers who probably are more influential, who are able to exert more pressure, if that is what is needed, and this would be the next step. I would agree.

Inasmuch as most of these manufacturers are fairly limited in size, their total contribution would be small.

Mr. SHEEHAN. It would be small. However, the whole is equal to the sum of its parts, and if all the small people got together, the boys on top would have to go to work.

Mr. BLOCH. Well, so far we haven't had any indication that it is going to cost us any money to do this. We feel that enough comes out of our taxes to take care of this, and that would be our answer and the employer's answer, I am sure.

What are we paying the taxes for?

Now, you have mentioned contributing sums of money. I wouldn't know to what purpose unless that would be the hiring of counsel to represent us; certainly, not to pay the smog czar to see that we emitted the smog.

But we will work as much as we can. We can put in the legwork and conduct meetings and things of that sort, but I don't know. If you will make suggestions for what purpose you need the money, what the money is for.

Mr. SHEEHAN. Somebody along the line has to do some research, and if the city or county officials, big business, or whatever it may be, don't do something, nothing will ever be done. Somebody has to get started. Maybe your particular industry and union can start it off by research through a university grant or something like that; something should be done locally.

Mr. BLOCH. I understand that research is being carried on by the oil refineries and the steel mills, and all of their research shows that it is not their fault.

Should then small business set up a research committee, a department, to try and disprove the theories of these multimillion dollar corporations?

I think we would be bucking our heads against a stone wall there. This would be then a fight between small busines against big business. Small business claims that it is big business that is to blame for most of the smog.

We would actually be engaged in a controversy with the oil industry, for example, here and probably the steel industry.

Mr. SHEEHAN. That would be——

Mr. BLOCH. I think that is a matter for the local authorities to fight out.

Mr. SHEEHAN. That would be all the more reason to spend some money on research just to make sure that you are not pinned for some blame you don't deserve.

Mr. BLOCH. Well, the only answer to that in this area that we use is to elect proper officials in office to see that they will do it.

Now, this is the program that the union follows. This is our only weapon and that is the ballot, and we feel that we would rather use, if we have to, to get the proper people elected into Congress and in our legislature here, and to our city council, who will take this fight up for us and they are being paid for through our taxes, so I don't think that we would be able to get any financial help from our particular branch of the industry.

Mr. SHEEHAN. That is all, Mr. Chairman.

Mr. ROOSEVELT. Mr. Prichard, do you have any questions?

Mr. PRICHARD. I would like to ask just two questions.

Mr. Bloch, you have suggested that this particular union has been affected by the smog.

From your acquaintance with the general situation in Los Angeles, what you have said about this particular union and this particular class of workers would apply to all the correlated industries in the area where people are dependent upon the use of their eyes in the doing of their work; is that right?

Mr. BLOCH. That is absolutely correct. I have witnessed an exodus of the insurance building on Eighth and Spring. Girls at 10 o'clock in the morning are filing out and they are all going home. These are office workers. The girls in our office have had to go home, and this is not the needle trade.

Now, while I am referring to the needle trade, there is another segment of the needle industry in this area. That is the ladies' garment workers who employ probably 15,000 or more, who are similarly affected.

Now, certainly, it would stand to reason that if it affects these people, it will affect the building trade workers, the carpenters, the plumbers, and it will affect anyone who is working and dependent upon their eyesight.

Mr. PRICHARD. Now, the other question I wanted to ask is this:

Regardless of what may be the cause of smog or who ought to investigate it, it is a fact that the loss resulting from the fact that there is smog falls upon two people primarily; first, the individual employee who takes a loss by reason of his own inefficiency, and, second, the small-business operator who employs people who are less efficient because of the smog?

Mr. BLOCH. That is correct.

Mr. PRICHARD. That is all.

Mr. ROOSEVELT. Thank you. Mr. Biscailuz?

Mr. BISCAILUZ. Can you actually trace a financial loss in the trade or is it just generally believed that the industry suffers financially as a result of our smog situation?

Mr. BLOCH. Well, there is a reflection in earnings. In the small businesses—I don't come prepared with actual facts and figures—but we know that many of our clothing manufacturers are pressed for deliveries due to the seasons.

Now, if a certain order is to be delivered to the store the week before Easter and the shop has to close down or the manufacturer can't get this work out, they have cancellations and there is a record of that that we can get.

There are cancellations due to slowdowns in the shop. Also buyers have to have their goods at a certain time. They prepare sales and they prepare advertising and all of their orders are subject to cancellation if not delivered on time.

Mr. ROOSEVELT. I think it would be of help to the committee, if my colleague agrees, if you could get from your industry or from any other industries figures as to the number of shutdowns that occurred because of smog; the number of cancellations; or any other factual evidence that would tend to give a picture to the full Committee to whom we will report, as to the actual loss suffered by small business. If you could furnish such data, I think it would be very helpful to the committee.

Mr. BLOCH. I would be happy to do so and turn it over to our research department, and if they can get those figures and if figures can

be made available to them, I am sure we will cooperate to the fullest extent.

Of course, many of our small manufacturers are vague on this matter. They say, "Sure, we lost money, but we can't say how much."

The workers, of course, lost a day's pay, and you don't make up a day's work.

Mr. ROOSEVELT. I think it might be a good thing in the future, presuming that this problem isn't going to be solved very rapidly, to keep such notations——

Mr. BLOCH. I definitely will.

Mr. ROOSEVELT (continuing). And forward them to us when they become available.

Mr. BLOCH. All right. That is right.

Mr. ROOSEVELT. Mr. Biscailuz, do you have any further questions?

Mr. BISCAILUZ. I have no further question.

Mr. ROOSEVELT. On behalf of the committee, we want to thank you, Mr. Bloch. If you have nothing further, you may be excused.

Mr. BLOCH. May I be excused from the room? I would like to go back to the office. Smog or no smog, people have to make a living.

Mr. ROOSEVELT. That is right. We appreciate your coming down. Thank you very much.

Our next witness will be Mr. Jules Furthman.

Mr. Furthman, if you are present, if you will come forward at this time, please.

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. Mr. Furthman, would you please raise your right hand.

Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth and nothing but the truth, so help you God?

Mr. FURTHMAN. I do.

Mr. ROOSEVELT. Thank you, sir.

TESTIMONY OF JULES FURTHMAN, OWNER OF THE FURTHMAN ORCHID NURSERY, CULVER CITY, CALIF.

Mr. ROOSEVELT. Mr. Furthman, I believe you represent the Furthman Orchid Nursery in Culver City, Calif.

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. Would give your name and address to the reporter, and then you may proceed in your own way.

Mr. FURTHMAN. I am Jules Furthman, F-u-r-t-h-m-a-n. 5940 West Jefferson Boulevard, Los Angeles.

Mr. ROOSEVELT. Mr. Furthman, would you please speak out. There are people in the back of the room, so will you speak out so they can hear you.

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. All right, sir. You may proceed, Mr. Furthman. I understand that you are in the orchid business and that you have some information which you would like to give to the committee in relation to the difficulties which smog has brought to you.

Mr. FURTHMAN. This is purely visual. I suppose you would like to see the effect of smog on orchids.

Mr. ROOSEVELT. I am sure all the ladies in the room would be glad to look at them, too.

(Whereupon the witness produced two orchids from a box.)

Mr. FURTHMAN. This is an orchid that is undamaged [indicating]. Here is one that has been damaged by smog [indicating]. It not only dwarfs the orchid, but it also dries the sepals. It doesn't affect the petals, but it does affect the sepals.

These are the sepals [indicating]. That damage occurs about 6 months of the year from October to the end of March. We are even getting it now.

A lot of people had their Easter crop and their Mother's Day crop affected by the smog.

Mr. ROOSEVELT. My understanding is that this damage occurs during the growing period, is that correct?

Mr. FURTHMAN. Yes; the blooming period.

Mr. ROOSEVELT. The blooming period?

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. Do you raise them indoors or outdoors?

Mr. FURTHMAN. They are raised in greenhouses; indoors, yes.

Mr. ROOSEVELT. And the smog penetrates into the greenhouses?

Mr. FURTHMAN. Yes, because we have to have ventilation, you know; for orchids, that is a requisite for them. They need a lot of fresh air. It would be almost impossible to shut off the—well, that damage, as far as we know, we have cooperated with the smog bureaus here, and they have made a very definite effort to ascertain the cause of the damage, and it is generally agreed that it is an ethylene gas, caused by the combustion of automobiles and burning of oil fuels.

Any form of combustion would create ethylene gas. Well, ethylene gas has a property of ripening fruits. As you know, probably they use it to ripen pineapples. It has that effect on orchids. It develops them prematurely and ages them prematurely. That is the trouble with that orchid. That is the condition of an orchid that is 10 or 15 days old instead of being just 3 days old, 3 or 4 days old.

The city of Los Angeles has done everything—I mean, so far as, you know, it made investigations, experiments. We have given the plants to them. You see, the orchid is very sensitive to smog. It isn't quite as sensitive as a lot of plants, but the white orchid succumbs very quickly to any smog damage. Then, the colored are later in their effects, so if the white orchid, which is very sensitive to light, gets it first, then, it is related—the smog damage is related also to the effects of light, and if it comes from a period of October to March. Those are the periods, October being a short day, short light period, and the damage disappears as the light periods get longer; that is to say, in March, so it must be some chemical effect that has not been noted yet as to effect of light and smog.

The plant, then, under those conditions would be more—with plenty of light—would be less susceptible to smog damage, as at the equator, which is its home. At a point of about 20 degrees from the equator, they have a 12-hour day.

Mr. PRICHARD. May I interrupt, Mr. Furthman?

Mr. FURTHMAN. Yes.

Mr. PRICHARD. As I understood it from my previous conversation with you, that you have converted into dollars and cents information regarding the damage that the smog has done in your business.

Mr. FURTHMAN. Oh, yes.

Mr. PRICHARD. Can you relate that, if you will, please, to the committee?

Mr. FURTHMAN. Well, as I say, here are some reports on—I think I am the only one who ever kept any records on smog damage. It is report as follows:

Monday, January 24, we cut a total of 918 orchids that day and 699 were good and 219 were dry-tipped.

Mr. ROOSEVELT. That was a smog damage?

Mr. FURTHMAN. Smog damage, yes. The dry tips are the ones that are damaged by the smog. It varies from day to day.

January 22, the damage was, out of a total of 408 orchids, the damage was 170.

January 21, out of a total of 468 orchids, there were 106 damaged. That is 25 percent.

Mr. ROOSEVELT. About 25 percent.

Mr FURTHMAN. Thursday, January 20, a total of 641 orchids; 171 were dry-tipped.

Wednesday, January 19, out of a total of 630 orchids, 230 were dry.

Tuesday, January 18, 594 orchids cut; 123 dry.

That is the way it goes from October to March. On some days it is more.

Mr. ROOSEVELT. Could you estimate your total damage from smog?

Mr. FURTHMAN. Well, in 19——

Mr. ROOSEVELT. Let us say for a year's period.

Mr. FURTHMAN. Yes. I would say we cut an average of from 150,000 to 200,000 orchids and the damage runs from 25 to 50 percent.

Mr. ROOSEVELT. In dollars, that would be——

Mr. FURTHMAN. Well, it's hard to figure, because we figure we get an average of $1 per orchid. That is right along. During holidays that figure runs up to $3 to $3.50, and we have set up our growing system so that we only have blooms during the holiday seasons, so whereas I would say, if I had lost 50,000 orchids, I lost $50,000. If half of these were at another period, I could easily double my loss I haven't figured it that way.

However, by the way, we ship orchids all over the country, so we would come under that interstate setup.

I think, as a matter of fact, I think we have less damage than most orchid growers. I think that other people have suffered very definitely much more than I have.

Mr. ROOSEVELT. Mr. Furthman, to your knowledge, does this same condition either in greater or less degree affect other, let us say, fruits and vegetables and other growers of other flowers and things of that kind?

Mr. FURTHMAN. I haven't done any research on that. We have spent an awful lot of money to try to discover, you know, the real cause, so we could combat it.

I know that affects leafy, all leafy shrubs and vegetables, I mean, that are high in nitrogen. The higher they are in nitrogen the more they are affected.

Mr. SHEEHAN. The nitrogen, in effect, is shut off?

Mr. FURTHMAN. Yes. Orchids use an awful lot of nitrogen. It is the general consensus of opinion of Rutgers University and at Cornell

that nitrogen—that leafy things and fruits and vegetables and flowers that are heavy in nitrogen suffer the most damage.

Mr. ROOSEVELT. You as an industry have not been able to find a way of treating the air within your own plant, and therefore, the only real answer is the elimination of the condition in the atmosphere, is that correct?

Mr. FURTHMAN. Yes. We have used every method, like using activated charcoal filters. Activated charcoal filters are supposed to remove that ethylene, you know, but you have to use—there are some other factors that you can use with activated charcoal, but they will do almost as much damage to the orchids as the ethylene. I mean——

Mr. ROOSEVELT. So your real solution is just the elimination of the smog——

Mr. FURTHMAN. Of the smog.

Mr. ROOSEVELT. From the atmosphere.

Mr. Furthman, may I make a suggestion. If there is a photographer in the room who would contribute his services in order that we might preserve the evidence, I think at this point I will submit——

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. For a minute and let you hold the two orchids that you submitted as evidence. Is there one of the photographers present who would be good enough to do a service to the committee?

A PHOTOGRAPHER. Yes.

Mr. ROOSEVELT. Thank you, sir. If you will come forward and Mr. Furthman, if you will hold the two orchids whatever way the photographer suggests would give us the clearest picture, please, of the damaged orchid and the good orchid.

Mr. FURTHMAN. Yes.

Do you want to get much closer?

Mr. ROOSEVELT. Frankly, I would like to have it photographed just for evidence.

(Whereupon photographs were taken.)

Mr. FURTHMAN. Do you think that will show up? Do you really think so? I don't. I have photographed an awful lot of orchids. If you want it, we could photograph them in color for you and I can send you the photographs.

Mr. ROOSEVELT. If you would do that, the committee would appreciate it.

Mr. FURTHMAN. Then, you can see it very clearly. There is no point in—they are only interested in getting news pictures.

Mr. ROOSEVELT. This was Mr. Prichard's suggestion.

Mr. FURTHMAN. It is a good suggestion.

Mr. PRICHARD. If you have color photographs all ready, Mr. Furthman, it would help a lot.

Mr. FURTHMAN. Well, I haven't got them.

Mr. ROOSEVELT. This evidence will disappear as you walk out of the courtroom with it.

Mr. FURTHMAN. Oh, yes. I can have prints made.

Mr. ROOSEVELT. Just to recap your testimony, so I can be clear: In your one concern, you figure that the adverse effect of smog affects you on a very conservative basis at least somewhere around $50,000?

Mr. FURTHMAN. Yes. That is a very conservative figure, because we get that damage during New Year's and Christmas, which are the

two best days, and we have set up a system so we can control the blooming period of orchids with light. By giving them long days, we can hold them so that they will bloom during the 2 weeks or 3 weeks of Christmas. So if we have a heavy smog damage, it means that we could get hit right in the nose, because if we get a 50 percent loss during Christmas and New Year's, you can imagine what would happen.

Mr. ROOSEVELT. Have you any copies of the records from which you read, Mr. Furthman?

Mr. FURTHMAN. No, but——

Mr. ROOSEVELT. I will ask counsel to make arrangements with you to have those photostated for the committee. If you will submit that portion of it which you care to submit for the committee's evidence, we will then make it a part of the record, if that is agreeable to you.

Mr. FURTHMAN. All right.

(Data requested was not submitted to the subcommittee.)

Mr. ROOSEVELT. Did you have anything else? I didn't mean to interrupt you.

Mr. FURTHMAN. Well, the main thing is the trouble—it's an amazing thing, the orchid business. I have 60,000 plants that are in 6- to 10-inch pots. They cover a space of around 80,000 square feet of glass. Those plants have a book value of $20 apiece. The structure, the heating, the whole setup, I would say is worth about a half million to $750,000, because you have to air-condition it much better than you would your own home.

These losses and the condition of the orchid business—the orchid business is not, oh, I should say it has fallen off 50 percent in the last 3 or 4 years; not due to smog but through strapless evening gowns and various other factors.

Dress manufacturers are using different colored materials that don't match orchids, and I should think—I mean, it was always very amusing to me that the farmers are making such a fuss about their situation. I mean, why wouldn't they support the price of orchids and flowers? Of course, it seems to me it isn't as funny. It could be——

Mr. ROOSEVELT. Mr. Sheehan and I represent urban areas so we can't comment on that at this time.

Mr. FURTHMAN. I mean I read a great deal about the plight of the poor farmer. We are an agricultural setup and we have investments much larger, but we have never dreamed of asking for such a thing, although with this smog, it easily can be called a disaster situation.

Mr. ROOSEVELT. In other words, what you want to emphasize to the committee is you are on the borderline of profit, and everything such as smog can very well push you into complete elimination?

Mr. FURTHMAN. Yes. Well, the situation is such that I am going to liquidate the business. There is no use operating under these conditions.

Mr. ROOSEVELT. In other words, because of the smog condition in Los Angeles, you cannot operate your business in the area?

Mr. FURTHMAN. Not at a profit.

Mr. ROOSEVELT. That is a very serious thing, because your location must represent a considerably valuable one from the point of view of the taxpayers in the area.

Mr. FURTHMAN. Oh, yes; yes, it is. It just happens that I am not entirely dependent upon the orchid business.

There is a thing which I might suggest, Mr. Prichard. Orchids are handled wholesale in Los Angeles. One of the largest wholesalers is on Wall Street called the Orchid Exchange.

Mr. ROOSEVELT. That is Wall Street, Los Angeles; not Wall Street, New York.

Mr. FURTHMAN. Yes, it is Wall Street in Los Angeles. But he is one of the biggest outfits here that handles orchids exclusively.

Now, these people—I don't remember his last name, but I think he would be glad to testify about the effect of smog because he is related to it a great deal and I am surprised that there aren't more flower people here.

Mr. ROOSEVELT. We have another witness here from the industry, and unfortunately, we weren't able to hear all of the ones or to confine it to just one industry. We have to cover the field.

Mr. FURTHMAN. Yes. They have always thought of the flower industry—I don't think it has been publicized properly, but they have always thought of the flower industry as something that just went along. It is one of the top 10 industries in the country. It is a big industry. It runs to $6 billion or $7 billion a year.

Mr. ROOSEVELT. And it is largely an industry of individual, independent operators.

Mr. FURTHMAN. Small people.

Mr. ROOSEVELT. Small business people.

Mr. FURTHMAN. Yes, small people. I dare say that my orchid range is one of the largest in the country.

Mr. ROOSEVELT. In dollar volume, it is among the first dozen, you say, of the industries in the United States?

Mr. FURTHMAN. The flower business; not the orchid.

Mr. ROOSEVELT. No; the flower business.

Mr. FURTHMAN. That is right. It is terrific. They just don't seem to get out and their damage goes from coast to coast. You know, they have dry tips in New York and all through the Middle West and they have it down in Texas. It is related.

Mr. ROOSEVELT. Wherever there is air pollution?

Mr. FURTHMAN. Yes.

Mr. ROOSEVELT. Mr. Sheehan, do you have any questions?

Mr. SHEEHAN. Yes. Mr. Furthman, I was interested in your remark in which you seemed to be rather positive of the fact that this ethylene derivative is the thing that is causing the problem in Los Angeles.

Mr. FURTHMAN. Well, we are not basing that on supposition. At Rutgers University and at Cornell, they were able to obtain this exact effect by the use of ethylene.

Mr. SHEEHAN. Isn't ethylene a gas derivative?

Mr. FURTHMAN. It is a gas. Ethylene is gas, which is caused by the combustion of any type of—any type of combustion.

Mr. SHEEHAN. I am not a Los Angeles resident, but I do remember reading recently someplace that the most recent studies seem to attribute the smog problem to the gasoline consumption in this area; at least, some eastern papers carried it.

Mr. FURTHMAN. Gasoline consumption creates ethylene. It is an ethylene producer. The gas that follows combustion or partial combustion of the gas can be ethylene. You can make ethylene gas with burning leaves, but I wouldn't say ethylene, but it is a positive fact

that research at both of those universities, they used ethylene gas and obtained these effects, so we can say the effects are precisely the same. I mean, the condition being the same, we must attribute it to ethylene gas but if you get rid of the combustion of those fuels, you get rid of ethylene gas.

Mr. SHEEHAN. Mr. Roosevelt, maybe we ought to, when the city and county officials come up here, make sure that they get in touch with Rutgers University—and what was the other one; Brown University?

Mr. FURTHMAN. No; Cornell.

Mr. SHEEHAN. See if they have been in touch with those universities and taken advantage of these studies.

Mr. ROOSEVELT. I will certainly ask them.

Mr. FURTHMAN. Yes. I will tell you that you can get a lot of information from UCLA. They have all of those pamphlets. You can get hold of the people in the horticultural department, the head of the horitcultural department at UCLA and they can give you all of these facts. They have been working on it for a long time.

UCLA has an experimental greenhouse. They have been studying the effects of smog.

Mr. ROOSEVELT. I think it will probably be brought out when we have some of the experts on it, the causes of smog, I am sure.

Mr. FURTHMAN. These effects have been noticed in California since 1940. That is when we began to have our first damage. That is when the first big industrial sweep came into here. The whites were always the same.

In the citrus industry, they noticed the oranges become smaller. There are periods of years when the oranges became very much smaller and they attribute that to the smog.

Mr. ROOSEVELT. It is a question of pinning that down to smog rather than to other causes.

Mr. FURTHMAN. But there is great variance of opinion about it.

Mr. ROOSEVELT. That is correct. Mr. Prichard, do you have any further questions?

Mr. PRICHARD. I have no further questions.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. I have no questions.

Mr. ROOSEVELT. I think the photographers would like to take pictures of you, Mr. Furthman.

(Whereupon pictures were taken.)

Mr. ROOSEVELT. On behalf of the committee, we want to thank you very much for your kindness in coming in and giving us this information. I am sure we will make good use of it.

Mr. FURTHMAN. Thank you. All right.

Mr. ROOSEVELT. The next witness the committee would like to hear from is Mr. Charles L. Washburn. Is Mr. Washburn present?

Mr. WASHBURN. Yes.

Mr. ROOSEVELT. Will you come forward, Mr. Washburn.

Will you raise you right hand, please. Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. WASHBURN. Yes, I do.

TESTIMONY OF CHARLES L. WASHBURN, REPRESENTING BASSETT & WASHBURN, KENTIA NURSERY, SIERRA MADRE, CALIF.

Mr. ROOSEVELT. Will you give your name and address to the reporter, please?

Mr. WASHBURN. Charles L. Washburn, 450 Bellmore Way, Pasadena.

Mr. ROOSEVELT. Mr. Washburn, we understand that you either are or have been connected with the Bassett & Washburn Kentia Nurseries, is that correct?

Mr. WASHBURN. Yes, sir.

Mr. ROOSEVELT. And that you would like to give us some information regarding the effect of smog in the northeast part of Los Angeles and that area, and because you are related to the same field that we just have had before us, I think this is an opportune time to proceed with your story.

Mr. WASHBURN. All right. From 1933 to 1953, with the exception of the World War II years, I was with Bassett & Washburn Kentia Nurseries most of the time as president of the corporation.

We grew as a primary crop Kentia palms, importing the seed from Australia and shipping the plants all over this country and to Canada. They are the palms which are used in hotel lobbies, at weddings and banquets, and so on.

We had approximately 22 acres of hothouses and an acre or so of greenhouses, as well as shops, packing houses and so on. Shortly—well, I will take that back. The sales in the business were quite uniform since the uses varied very little from year to year.

After World War II, our annual volume was aproximately 100,000 in Kentia each year and remained so until 1949, at that point falling off to a low finally in 1952 of approximately 13,000.

The plants started to show deterioration that we first noticed in around 1947 and 1948. We were unable to attribute it at that time to any particular factor and our efforts were confined primarily to keeping very accurate growth records, which we had always done by blocks and running comparisons. We found that each year we were getting poorer and poorer results.

Subsequently, we retained a chemist to do some work and UCLA cooperated and let us use some of their gas chambers and we pretty well found out what it was, and with the general amount of publicity given to smog, we felt that a minor correction would be sufficient not to cause damage of the financial nature which we were experiencing.

We determined to carry the business on to see if we could salvage it and also at that time to try and convert to some other crops.

In 1952, it was just apparent that we had had it. The business was liquidated. The inventory of Kentias which had a cost of $320,000, somewhere in that area, was sold for $10,000. The buildings with a replacement value of probably $15,000, at least per acre on the lath and probably $2 a square foot on the glass, we had to pay to get them to take it down.

That is about the size if it.

Mr. ROOSEVELT. In other words, you went completely out of business?

Mr. WASHBURN. That is right. I feel rather bitter personally since when I returned when I got out of the Navy, I managed to buy control of the company.

Mr. ROOSEVELT. Mr. Washburn, then, in essence, your testimony is that this problem is one which has resulted in your going completely out of business.

Is it your observation that other companies are in similar situations?

Mr. WASHBURN. Yes, sir; that is correct.

Mr. ROOSEVELT. So while the committee can't be of much assistance to you, sir, your hope is that we can be of some help to others?

Mr. WASHBURN. The horse has long gone from the barn, sir.

Mr. ROOSEVELT. Mr. Prichard, do you have any questions?

Mr. PRICHARD. I have no questions.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. No questions.

Mr. SHEEHAN. No questions.

Mr. ROOSEVELT. We want to thank you, Mr. Washburn, for appearing before this comittee.

Mr. WASHBURN. Those figures are quite accurate. They are as close as we could get them without the actual statement.

Mr. ROOSEVELT. We will put your letter to me in the record. Thank you, sir, very much.

Mr. WASHBURN. All right.

(The letter referred to is as follows:)

PASADENA, CALIF., *January 16, 1956.*

Hon. JAMES ROOSEVELT,
House of Representatives,
House Office Building, Washington, D. C.

DEAR SIR: I have been advised of your interest in a comprehensive study of smog and the damage it has caused. I, therefore, am writing to inform you of a substantial loss incurred due to the effect of this blight.

Bassett & Washburn Kentia Nurseries, incorporated in the State of California in 1928 and located northeast of Los Angeles in the city of Sierra Madre, operated approximately 25 acres of lathhouses, probably the most extensive in the world, together with rather extensive greenhouses, shops, warehouses, and shipping facilities. For many years its sole product was Kentia palms which were shipped all over the United States and Canada. These are the palms used in hotel lobbies, at weddings and banquets, and for other indoor decoration.

Since World War II the amount of smog in the Los Angeles basin rose to a point that foilage was destroyed more rapidly than new growth could replace it. The plants became unsalable to the florist trade. Market, technical, and cultural problems prohibited a change to the production of other types of plants and in 1953 it was necessary to liquidate the company. $10,000 was received for the palms against an inventory cost of approximately $350,000. Nothing was received for the lathhouse, the replacement value of which would have exceeded $250,000.

I was associated with the firm personally from 1933 until liquidation with the exception of the World War II years. From 1937 on, my position was that of president of the corporation. At the time of liquidation my wife and I owned over 50 percent of the outstanding stock.

I therefore most sincerely request that an open investigation of the damage smog is causing be made and a date set for such an investigation.

Very truly yours,

CHARLES L. WASHBURN.

Mr. ROOSEVELT. The next witness is Mr. Wilcox, Mr. Franklin K. Wilcox, if he is present.

Mr. WILCOX. Yes.

Mr. ROOSEVELT. Mr. Wilcox, would you hold up your right hand? Do you solemnly swear that the testimony you are about to give before

this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. WILCOX. I do.

Mr. ROOSEVELT. Thank you, sir.

TESTIMONY OF FRANKLIN K. WILCOX, OWNER OF KEELINE-WILCOX NURSERIES, MONTEBELLO, CALIF.

Mr. ROOSEVELT. Mr. Wilcox, would you give your full name and address to the reporter, please?

Mr. WILCOX. Franklin K. Wilcox, 625 North Montebello Boulevard, Montebello, Calif.

Mr. ROOSEVELT. Mr. Wilcox, we understand that you are associated with Keeline——

Mr. WILCOX. Keeline.

Mr. ROOSEVELT. And Wilcox Nurseries, is that right?

Mr. WILCOX. Yes.

Mr. ROOSEVELT. In view of what we have been hearing, we would be delighted to hear from you at this point.

Mr. WILCOX. Well, my testimony more or less carries out exactly what Mr. Washburn testified, Mr. Roosevelt.

We have been in business in Montebello and in Orange County, as I pointed out in my letter, since 1919, and the Kentia or the palm business is one of our departments in our nursery business.

It has been a very successful business, and it is more or less duplicated in size and in gross sales exactly as Mr. Washburn testified. We had also a little better than 22 acres of lath houses and our gross sales also were around $100,000 a year.

In our business, in the Southeast, we noticed the change in the scleritic condition of the palms in about 1952. We made many different tests and experiments, both with the University of California, UCLA, and also the University of California at Riverside.

The University of California at Riverside told us that it looked like the only thing that we could do was either to air-condition our houses or to move to another location. Of course, both ideas were uneconomically sound. We made some experiments and moved some of our young material to Santa Barbara to change the environment and we did prove to ourselves that the palms were in perfect condition up there. They grew successfully. They were of dark green color and we could have moved up there.

However, we weren't in a position to spend that kind of money to make such a large move, so in 1954, we decided it was going to be necessary for us to liquidate and it now has turned out that we have made our last shipment of Kentia palms to the East this last spring. I think the last carload shipment to New York was in May, this May, so we are another example of small business that has liquidated. We are out of the Kentia palm business.

We are continuing, of course, with our general line of nursery. A business that was in operation successfully for 35 years has also gone by the board.

Mr. ROOSEVELT. In other words, the lesson to be learned from your testimony is that there is danger that the county will lose a very important industry completely from the area because, in your opinion, you have successfully proven that this condition which has affected

you does not exist 60 or 75 miles to the north of us in Santa Barbara and that therefore, the only solution, if you were economically able to do it, would be to pick up and move out of Los Angeles County; is that right?

Mr. WILCOX. That is right. That is right; yes.

Mr. ROOSEVELT. Mr. Sheehan?

Mr. SHEEHAN. Mr. Wilcox, on the sale of these Kentia palms, with you and Mr. Washburn going out of business, there is $200,000 worth of business roughly. Is that being taken up by someone else?

Mr. WILCOX. It will be probably on a smaller scale in Santa Barbara, but I might point out that it will take 5 or 6 years for them to get into gear because it is a 6 to 7-year crop. In other words, from the time the seed is planted until it is marketable, it averages 6 years.

Mr. SHEEHAN. But definitely, it is going out of the Los Angeles area and into another area?

Mr. WILCOX. It has gone; yes.

Mr. SHEEHAN. So, therefore, the county and the city of Los Angeles has lost workers and, as Mr. Roosevelt has pointed out, is losing tax dollars——

Mr. WILCOX. That is right.

Mr. SHEEHAN. Because of these conditions?

Mr. WILCOX. Yes.

Mr. SHEEHAN. That is all, Mr. Chairman.

Mr. ROOSEVELT. Mr. Prichard?

Mr. PRICHARD. No, sir. That is the story. I think that pretty well tells it.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. So you would say then that you solely went out of business on account of the smog situation and for no other causes?

Mr. WILCOX. No other causes; definitely.

Mr. BISCAILUZ. I have no further questions.

Mr. ROOSEVELT. I would like to ask just one more question.

In your efforts, obviously you didn't allow this to happen without making every effort to see that something was done to save you. What did you do on the local level as far as getting in touch with the enforcement agencies that exist to try to see that something happened that would save your business?

Mr. WILCOX. Well, we worked with the University of California, UCLA, and they proved to us that it was not anything else but smog. I mean, we worked from a nitrogen and a fertilizing point of view and also from a bacterial point of view and there was nothing that they could recommend except change in the environment.

The University of California at Riverside reported the same thing. I used to call up Mr. Larsen periodically and report to him some of the smoke and gases that were being blown off from the Wilshire Refinery down there and they would send an inspector over there and they would call me back and say that they were glad that I had called and that there were gases being blown off. That was about the limit of it.

Mr. ROOSEVELT. In other words, from your point of view, the emphasis is not that you need more research as to what hurt your business; you know what hurt your business.

Mr. WILCOX. We know what hurt our business; that is correct.

Mr. ROOSEVELT. It is smog.

Mr. WILCOX. That is correct.

Mr. ROOSEVELT. Therefore, the emphasis is on getting rid of it on the local level, enforcement or whatever it takes to control the situation; is that correct?

Mr. WILCOX. Well, we would hope that in some way the Federal Government could coordinate the different work that is being done all over the country now, and if in any way the Federal Government can help our local government, we want them to do so.

We still have a large investment in the rest of our business and we hope that the relief of smog will aid in the growing of plants; and our plants particularly, because there is no question that if it kills some plants, it is harming others, maybe not to the point that it kills them but it is going to retard their growth and naturally we are all in business to make money and the faster we can grow these trees and shrubs and get them on the market, why, the better off we all are.

Mr. ROOSEVELT. You also ship in interstate commerce; do you not?

Mr. WILCOX. Yes. The Kentia palm was entirely interstate commerce. When I say entirely, I would say 95 percent of it. The nursery business partly is interstate commerce.

Mr. ROOSEVELT. Do you feel that the Federal Government has an obligation to point out to local authorities the steps that could be taken by local authorities to effectively eliminate smog?

Mr. WILCOX. I think if it has any suggestion or has the ability to help, it should, yes.

Mr. ROOSEVELT. In other words, that by cooperating in pointing out available machinery that might be available to curb the emission of smoke into the atmosphere or in helping to coordinate such devices as may be necessary for the control of exhausts from automobiles and trucks and buses——

Mr. WILCOX. That is right.

Mr. ROOSEVELT. You feel that that is the proper field for Federal cooperation, and then it becomes the job of local authorities to enforce whatever is indicated will do the job; is that correct?

Mr. WILCOX. I feel that there may be some controls necessary on the Federal level to force the automobile industry to develop means to reduce the gases that are given off by trucks and autos, yes; that is one phase of it.

Mr. ROOSEVELT. Well, now, when you say that the Federal Government should force them to do that, isn't the proper body to do that the local authority and merely for the Federal Government to ascertain that such projects are available or such devices are available, and therefore, it is simply the exercise of the local police power to make use of what the Federal Government has found could be or are available to curb the emission in the air of whatever is creating smog; is that correct?

Mr. WILCOX. I think that would be correct; yes, sir.

Mr. ROOSEVELT. I have no further questions.

Mr. Wilcox, we want to thank you for your cooperation and testimony with the committee.

Mr. WILCOX. Thank you.

Mr. ROOSEVELT. The committee will next hear from Mr. Stephen Royce, if he is present. Is Mr. Royce present?

Mr. ROYCE. Yes.

Mr. ROOSEVELT. Will you raise your right hand, please? Do you solemnly swear that the testimony you are about to give before this

committee shall be the truth, the whole truth and nothing but the truth, so help you God?

Mr. ROYCE. I do.

TESTIMONY OF STEPHEN ROYCE, GENERAL MANAGER OF THE HUNTINGTON-SHERATON HOTEL, PASADENA, CALIF.

Mr. ROOSEVELT. Would you give your name and address to the reporter, please?

Mr. ROYCE. Stephen Royce, Huntington-Sheraton Hotel, Pasadena, Calif.

Mr. ROOSEVELT. Mr. Royce, I believe you are the executive vice president, is that correct? What is your official title?

Mr. ROYCE. General manager of the Huntington-Sheraton Hotel.

Mr. ROOSEVELT. General manager of the Huntington-Sheraton Hotel?

Mr. ROYCE. Yes.

Mr. ROOSEVELT. We are very happy to have you here and we would be very glad to have you proceed in your own way as to the effect that smog has upon your business and which in general, I would call an important part of the tourist busines or tourist trade of this area.

Mr. ROYCE. Well, my present job is general manager of the Huntington-Sheraton, but for 30 years I was owner and manager of it before this, and our principal business was tourist business. I think that I probably have been in this fight against smog longer than anybody, because I realized earlier than most anyone else the harm that smog could do to the tourist business unless we could correct it.

I think I am probably the first person to ever spend $5 on employing anyone to try to find out what it was in the first instance.

I engaged a man, General Thomas, to come on my staff and I said, "You have no other job except to find out what smog is and what we can do about it," because we were getting complaints from guests, and they would say, "I don't think I will be back next year unless something can be done about it."

Well, at that time—I think that was about 1945—it was surprising how little anybody knew about smog. We got everyone that we knew to come in to struggle with it. We got Dr. Millikin and different ones, but no one really knew what the cause was. We thought about the incinerators, the refineries, the butadiene plant over in Los Angeles, but nobody really knew, and I think I probably had the first citizens' committee formed to try to find out something about it.

We didn't get very far with it until Norman Chandler formed a citizens' committee and got Mr. Jeffers, the former rubber czar, to act as chairman of that committee, and then, we realized the first thing we had to do was to get a law.

Mr. ROOSEVELT. What year was this?

Mr. ROYCE. I think it was in 1947. We had to get a law to enforce whatever procedure we had that we wanted to make, and that law was written by some of the very good attorneys of Los Angeles and Mr. Kennedy, the county counsel, and it is an excellent law and it still is as good as when it was passed. I mean, I don't think it should be amended.

Now, smog has increased since then, since we started on this, but——

Mr. ROOSEVELT. May I interrupt you just one second?

In general, what the law sets up is a smog control district, is that right?

Mr. ROYCE. A smog control district; that is right.

Mr. ROOSEVELT. With an enforcement officer at the head of it?

Mr. ROYCE. Yes; that is right; a director.

Mr. ROOSEVELT. Under conditions which give him certain police powers for the control of the emission into the air of the smoke or whatever it is that creates smog?

Mr. ROYCE. That is right.

Mr. ROOSEVELT. Is that a general description of the purpose of the law?

Mr. ROYCE. That is right.

The first smog director was MacKay. At that time, to show what a complicated problem this is, at that time we felt that if we could lick sulfur dioxide which was emanating from the refineries of gasoline and some other sources, that our problem was solved, but there is probably less sulfur dioxide going into the air today than there was then, and we still have more smog. In other words, as we got into it, we found it was a very, very complicated problem and a scientific problem and it had to be solved on scientific lines.

Now, I am here to testify about the harm that is done to the hotel business. I didn't bring any letters or any factual evidence, but I can tell you that it has practically ruined the resort hotel business in this area, because the damage done is cumulative. A person will write out and say, "I am not coming out this year because I think that the smog is so bad that it affected me," and they will tell everyone else in their area that they are not coming. It is hard to pinpoint it, but I could bring many, many letters showing how it has affected us, of people who now go to Florida, who go to the Caribbean, who go to La Jolla, Santa Barbara, and Arizona.

It has affected us tremendously.

Now, I don't know whether you care to have this or not, but my feeling is that the Government could help us by allotting funds for research. I don't think we have still done quite enough research on this. There are lots of things we do know that are contributing to smog and they should be corrected, but there are other things that we are not sure of.

I don't think that the Government should interfere in the enforcement. I think that is a local problem. I think it is a problem which we should handle right here locally and not across State lines.

Some of us who have given a good deal of thought to this matter feel that probably a commission should be established to take the place of the board of supervisors who are now the Smog Control District members. The reason for that is not that the supervisors are not trying to do a good job as they can do; they are. I have no criticism of them in any way whatsoever, but they have got other duties. One day they are on taxes; another day they are on sewers or highways and any number of problems that come up in the governing of a county as large as Los Angeles, which I understand has a population with only seven States larger than Los Angeles in population.

We feel that a commission should be established, maybe of five members and maybe two from Los Angeles County, one from San

Bernardino County, one from Riverside County, and one from Orange County, a district whose sole job it is to look after the administration of smog.

This is an everlasting and a continuous problem. At first, we thought when we licked the sulfur dioxide we could all sit back and say, "We have got clean air again." But there are more automobiles every day. There are more incinerators every day. There are more people every day. Everyone is a contributor.

I think unless we have someone who is on this continuously, whose job it is solely, and they should be well paid men and maybe appointed by the Governor—I haven't gone into the details of that, but it should be a governing board whose sole job it is to look after air pollution, the same as the board of health and the water board that we have and the other commissions.

Mr. ROOSEVELT. Mr. Royce, can I ask you at that point: Do you think, because of the Federal interest involved, particularly in the tourist business which is interstate business, the business that you have heard discussed here today and others, as well as the health angle, which I think will perhaps be brought out later in the hearings, that a representative of the Federal Government should sit on that board; or would you advocate that it be wholly made up of local members?

Mr. ROYCE. I think it should wholly be made up of local members who are answerable to the people of this area. I mean, if they are not doing a satisfactory job, there will be some way of replacing them on that board by someone that we feel would be doing a good job.

Mr. ROOSEVELT. Therefore, the Federal contribution, in your opinion, should be wholly directed for funds toward research, both as to the materials that make up smog, the chemical materials that make up smog, and the devices that may be used in its control?

Mr. ROYCE. I think so. I think they could maybe contribute in that way, and also with technical advice, but as I said before, this is a local problem. It is a problem we should solve here ourselves. We haven't maybe done as good a job on it so far as a lot of us had hoped could be done, but the more we got into it the more complicated we found it was. I know that we are on the verge of licking the automobile exhaust with attachments to carburetors and after-burners. It is in the final stages now. It has taken a long while. There are other problems which are being solved along the same lines, but those things take money; I mean, it is the research, the money for that research is where I think the Federal Government could help us more than in any other way.

Mr. ROOSEVELT. Now, Mr. Royce, you are familiar, however, with the fact that there have been Federal funds provided. It isn't that the Federal Government has not made available certain funds, but——

Mr. ROYCE. Yes.

Mr. ROOSEVELT (continuing). Those funds have been used in conjunction with private funds, university funds and funds of that character, and is your impression that this money has not been sufficient; that sufficient research has not been available?

Mr. ROYCE. I think that the largest amount of money that is appropriated by the Federal Government for this purpose should be alloted to this district, because we are further along with our experiments and with our research here than in any other part of the United States.

It is because it has been our problem longer and this problem differs from the one in Pittsburgh. We have got fumes here. We have gasses. There in Pittsburgh theirs was more smoke and dirt and dust.

Mr. ROOSEVELT. On the basis of the numbers of people affected, this is the area which has the greatest interest, let us say, in the solution of this particular problem?

Mr. ROYCE. I feel our money would be better spent here because we are further along and we would solve it quicker and the other parts of the country could take advantage of it, because I think it is only a question of time before the automobile exhaust problem will probably be a problem in many cities outside of this area.

Mr. ROOSEVELT. Well, I think for the record we should note that the problem is one that roughly affects 200 other communities throughout the Nation today, so it is a problem which is not localized in Los Angeles, although it may have different reasons and there may be different components in the air here than there are in other areas.

Mr. ROYCE. That is right.

Mr. ROOSEVELT. Mr. Royce, would you say that this effect which you have found in your hotel business is affecting all of the hotel trade in the area?

Mr. ROYCE. All of the hotels in this area, yes, very seriously.

Mr. ROOSEVELT. And, therefore, all related industries must also be affected by it?

Mr. ROYCE. When people don't come to the hotels here, they don't buy anything else. They just don't come to this area.

Mr. ROOSEVELT. Mr. Sheehan?

Mr. SHEEHAN. Mr. Royce, you are touching upon a point that I would like to pursue a little bit further.

As you well know, in a big city like this, you have a convention hall and convention facilities; is that not right?

Mr. ROYCE. Yes.

Mr. SHEEHAN. Naturally, a part of the hotel business and a part of the chamber of commerce business is to bring convention visitors and resort people into this city.

Mr. ROYCE. Yes.

Mr. SHEEHAN. The net result of that usually is that the chamber of commerce and the hotel operators usually get together and put up funds to encourage trade into the city; is that not right?

Mr. ROYCE. That is right.

Mr. SHEEHAN. Well, it would seem to me, if this smog is doing such damage, that between the chamber of commerce and the hotel operators, they would get together a good sum of money to make sure that this thing is investigated thoroughly so that there is some scientific knowledge on it even if the city wouldn't do a thing about it.

Have the operators gotten together on a fund like that?

Mr. ROYCE. Not in a large way. In a small way, yes.

Mr. SHEEHAN. Now, I am only trying to be realistic. For instance, when the convention went to San Francisco, somebody had to raise a half million or a million dollars to bring it there, and most of it came from the chamber of commerce and the hotel operators.

Mr. ROYCE. I think that probably I have contributed somewhere in the neighborhood of probably $20,000 to date.

Mr. SHEEHAN. Over a period?

Mr. ROYCE. Yes.

Mr. SHEEHAN. Well, have the other people in your industry done anything?

Mr. ROYCE. Some of the other hotels; not all of them. You have to depend on certain hotels. It seems to be a characteristic of the hotel business that they don't all want to come in.

Mr. SHEEHAN. It is true in every industry, but that again, then, raises some questions in my mind. I am not a resident of this area, so I can ask these questions from ignorance.

You, in 1947, had a smog-control district. Certainly, they must be doing a lot of things to enforce the laws or the rules and regulations to make for an abatement of this nuisance; is that not right?

Mr. ROYCE. That is right.

Mr. SHEEHAN. Now, where does the problem lie? Is it insufficient enforcement?

Mr. ROYCE. I don't think it is as much insufficient enforcement as the fact that the area is growing so fast and that they haven't found a solution or reason for the cause of a good deal of the contributories. For instance, a lot of work has been done at the refineries. We at first thought that a good deal of the cause of smog was right from the refineries. A good deal of the refineries have done a lot of work. I still think there is a lot to do.

The automobile hasn't been touched yet, and there are more and more automobiles coming into the area every day. There are more and more backyard incinerators every day. I think backyard incinerators are just as outdated as the old-fashioned Chic Sales, and it has no place in the modern community and it ought to be eliminated. It hasn't yet, and until it is, it is an increasing problem.

Mr. SHEEHAN. As a resident of the city of Chicago, I would agree with you because we have our own collection of garbage and we don't leave it up to the individual property owner to burn it. It is disposed of away from the city, and practically all of the metropolitan cities have it, like New York. They have a collection of garbage and refuse disposal and don't permit it to be burned in the city so that the fumes are scattered all over.

You mentioned several things, such as, smoke and fumes and gasses. Do you have sufficient ordinances here to enforce laws so that gasses and smoke don't escape into the city?

Mr. ROYCE. I am not sure about the fumes. I don't know whether you can differentiate between the fumes or not. I mean, I am not technical enough to know that, but on the smoke, yes.

Mr. SHEEHAN. Because we do have that problem in Chicago, and I do know that we do have in our city ordinances that if any commercial factory spouts fumes or gasses into the air, the city officials are able to come in and either shut the place down or make them do something about it.

Mr. ROYCE. Well, you can probably detect the fumes right from a stack that are going out there. There are lots of cases of it.

Mr. ROOSEVELT. You can smell them, I presume, too. If there are fumes, there are odors.

Mr. ROYCE. Just smelling, I don't think, is enough.

Mr. SHEEHAN. We also have in Chicago—I don't know what the newspapers do here, but in the emission of black smoke, we have one Chicago newspaper who does this: Anyone who violates the ordinance,

they always get a photographer there and if black smoke comes out for more than 5 minutes, they have a picture of it in the paper and the fellow who is violating the ordinance, and they don't like that kind of publicity.

It seems to me, and I am strictly an outsider, but it looks to me as though the city of Los Angeles or the county is remiss in their duties someplace. [Applause.]

Mr. ROYCE. It could be.

Mr. SHEEHAN. That is all, Mr. Chairman.

Mr. PRICHARD. May I ask just two questions? You have indicated that there is an industry that, for a better description, you call the tourist trade, and you haven't brought us any precise figures, but can you tell us, in general terms, what is the annual volume of the tourist trade in this area?

Mr. ROYCE. No; I can't. The All-Year Club could give you that, but I haven't that information. They could tell us.

Mr. PRICHARD. Can you give it to us even in generalities?

Mr. ROYCE. No.

Mr. ROOSEVELT. Is it in excess of a hundred million dollars?

Mr. ROYCE. I think it is; yes. Yes; I think it is.

Mr. PRICHARD. Can you give us some kind of an estimate percentagewise as to what damage you think is done to that tourist trade by the smog?

Mr. ROYCE. No; I can't give you that. I can't give it to you in percentages. I didn't know I was to attend this hearing until last night, and I didn't get a chance to get anything together on it in factual figures or anything.

Mr. ROOSEVELT. Would you feel that the All-Year Club has available those figures and could give us the figures as to the approximate loss that the area has suffered in tourist trade?

Mr. ROYCE. I doubt if the All-Year Club could give it to you in the tourist business, because their figures are all inclusive. I mean, they take all automobiles that come into the area, whether they are tourists or travelers; I mean, on business and the like.

Mr. PRICHARD. Could you do this for us: Could you tell us what the minimum would be? Would it be at least a minimum of, let's say, 10 percent or 15 percent or 25 percent, whatever the minimum would be?

Mr. ROYCE. Of our loss, you mean?

Mr. PRICHARD. Of the loss in tourist trade resulting from smog.

Mr. ROYCE. Well, I would think the minimum would be 25 percent.

Mr. PRICHARD. All right. Thank you.

Mr. ROOSEVELT. Would it be true that perhaps this loss has not been noticed as much as it should be because of the fact that increased business in the area has filled up the hotel rooms?

Mr. ROYCE. That is right.

Mr. ROOSEVELT. So that there is perhaps no acute feeling of it at the moment, although there has been a loss in the tourist trade itself?

Mr. ROYCE. That is right. What I call the tourists are: They come here for sunshine and climate and that is what attracts them. If you take away the sunshine and the climate and bring in smog, you have taken away the greatest attraction of southern California.

Mr. SHEEHAN. Mr. Chairman, may I facetiously get in a remark?

I was in Florida last November and I heard Mr. Knowland on the same platform with Mr. Smathers, the two Senators, and they were both discussing sunshine in their respective States and Mr. Smathers wound up by saying, "We both have the same sun but we see it."

Mr. ROYCE. I might add to that that Senator Smathers' father spent the winter before at the Huntington.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. I have just one question. Although you state there is a loss in the tourist trade, what about the convention trade? Hasn't that increased?

Mr. ROYCE. I don't think it has. Well, I can't speak for the city of Los Angeles, whether that has increased or not, but I do know that we have come very near and probably may lose two conventions which we thought we had definitely booked because other areas have brought up the question of smog in this area and have influenced them to go to other places.

It is an ever-increasing problem, because every other area that is competing with us takes advantage of it and that is their No. 1 argument for attracting trade that would be directed here.

Mr. BISCAILUZ. I believe that is all.

Mr. ROOSEVELT. Thank you, Mr. Royce, very much. We certainly appreciate your coming in and giving us your helpful testimony.

Is Mr. Karbiner here? Mr. Francis Karbiner.

(No response.)

If he is not here, then, at this time, in order to accommodate Mr. Arthur Will, executive officer of the board of supervisors, if Mr. Will is here——

Mr. WILL. Yes.

Mr. ROOSEVELT. We would be happy to hear you at this time, because we know your time is limited.

Would you just identify yourself and give your official position and your address to the reporter?

Mr. WILL. Arthur J. Will, chief administrative officer of Los Angeles County.

TESTIMONY OF ARTHUR J. WILL, CHIEF ADMINISTRATIVE OFFICER OF LOS ANGELES COUNTY, CALIF.

Mr. ROOSEVELT. Now, Mr. Will, the committee received copies of the resolution adopted by the board of supervisors requesting restoration of the sum cut by the House of Representatives from the $3 million allotment and also pointing out the increased need for Federal funds for research in the area.

We are very happy to have you here. We have made the resolution a part of the official record of the committee and we would be delighted to have you make any comments on that or anything else that you would like to comment about at this time, particularly, of course, in reference to cooperation or assistance from the Federal Government, and we would apreciate it if you would define for us where you think the responsibility of the board of supervisors rests and where the responsibility of the Federal Government begins.

Mr. WILL. Well, first let me say that we are very delighted to have the Federal Government participate at all, because we recognize that

while this is a problem that will affect every metropolitan area in the world and probably should be considered proportionately a local problem in those particular metropolitan areas, at the same time, everything that is done in a local community is for the benefit of every other metropolitan area that has difficulty of this character.

The county of Los Angeles is first, under the State law, responsible for the passage of ordinances to enforce rules and regulations to alleviate and eventually eradicate smog in this area. In order to do this, the board of supervisors has, after considerable study from time to time, adopted rules and regulations governing certain types and kinds of devices, factories, automobiles, trucks, buses, incinerators, open burning, and so forth, to the end that they could then enforce a program that would carry out the spirit of these regulations, which is all one, and that is to eliminate insofar as possible the air contaminants.

Now, in the preliminary work that has to be done, there is a tremendous amount of research, and if you could imagine as a perfect example, the automotive industry for the second time in its history has formed a joint committee to work out arrangements whereby they can reduce air pollution from their exhaust pipes.

The first time that they formed a joint committee was on sealed beam headlights. This is the second time. Everything else that they do is top secret, and it is worth your life to get it out of an automobile factory, just the same as it would be out of the Pentagon. It is top secret.

So, for the first time, the automotive industry—or the second time the automotive industry has stepped into this kind of joint program, and they have a great committee headed by Mr. Chain, who is the vice president in charge of engineering of General Motors and every automobile manufacturer is represented. They have been working for 5 years on this problem and they have yet to come up with a simple, reasonable device that can be attached to an automobile that will not interfere with its performance and will at the same time, reduce the air pollutants that are emitted from the exhaust.

Mr. ROOSEVELT. Could I interrupt you at that point, Mr. Will?

Was not the first committee formed because of local ordinances that were being enacted under the police power of the State for safety reasons and that therefore, in order not to have a complete almost chaotic condition in relation to headlights, the industry was more or less forced to move ahead and to do something about the situation, but it was forced——

Mr. WILL. Yes.

Mr. ROOSEVELT (continuing). To do so because of local action and local insistence?

Mr. WILL. That is correct. The same thing is occurring now because we have been saying to them, "You must find a method to reduce these contaminants," because we have reached a point where now from our own research and the research all over the world on this subject, from all that we can gather and all that we know, that the principal source of air contaminants left in large metropolitan areas over which there is no control is now the automobile and the truck and the bus.

Mr. ROOSEVELT. Then, you are saying that the board of supervisors

has decided that the principal cause of smog is the emission from trucks, buses, and automobiles; is that right?

Mr. WILL. The principal smog, cause of smog that is left unsolved——

Mr. ROOSEVELT. Unsolved?

Mr. WILL (continuing). On which there is very little knowledge as to how to eradicate it is on automotive—on the automotive equipment that is in this area. We increase in the number of cars and trucks and buses every year in this area to an amazing degree.

We have 2,600,000 registered vehicles in Los Angeles alone besides all of the visitors that come in, not only visitors from distant points but people from close counties, such as Riverside, San Bernardino and Ventura and Orange and so forth, so that there are in operation, I would assume, over 3 million automobiles, trucks and buses in this county almost continuously right now; and every year, we are adding to that certainly well over 100,000 new passenger cars just in local registrations.

Now, I gave you this merely as an answer to the original question to indicate that it is almost—it is a very difficult thing to find the true means of eradicating a lot of these problems.

Mr. ROOSEVELT. May I ask you whether the board of supervisors has set up a committee to examine known devices, many of which our committee has been informed of and I am sure the automobile industry have.

Has the board of supervisors set up any kind of a unit through which these can be screened?

Mr. WILL. Yes.

Mr. ROOSEVELT. Would you tell us what has been done by the board of supervisors on that phase of research?

Mr. WILL. Generally, they have authorized the air pollution control district to employ consultants to work with their own scientists who investigate every type and kind of a device that is offered, a muffler control or a precombustion device, or whatever it may be, to be presented to them by some manufacturer or some inventor to be examined and carefully studied.

Mr. ROOSEVELT. Has the air pollution control district made any reports to the board of supervisors on the value of any of these devices?

Mr. WILL. Oh, yes, yes.

Mr. ROOSEVELT. Could the committee have copies of such reports?

Mr. WILL. I would suggest—I understand that you are going to hear from Mr. Griswold tomorrow.

Mr. ROOSEVELT. We are.

Mr. WILL. He has all of those details and he would be very glad to give them to you at that time.

Mr. ROOSEVELT. You suggest that we get the reports that have been submitted to you from him rather than have them come from you?

Mr. WILL. That is right. He will bring them to you tomorrow and he will see that you get a suitable number of copies.

Mr. ROOSEVELT. Is it, as of now, the opinion of the board of supervisors that no satisfactory known device exists for the control of automobile combustion or gas emission?

Mr. WILL. No; that is not quite true at this minute, but we have tried to work with the automobile industry as a whole to give them

time to develop a device that would not be too expensive for the people who already own cars to have them installed in their automobiles.

In other words, the simple problem would be to put it on new cars but that would only affect a few cars a year.

Mr. ROOSEVELT. However, if it were put on new cars immediately, would not the public insistence that it go on all cars be rather effective?

Mr. WILL. If there is a possibility that we had a piece of equipment that was not too expensive so that we wouldn't have to ram a $95 equipment down the throat of an automobile owner to put on an old car, we would immediately pass a rule that that must be on every car until some other more beneficial instrument is found.

As a matter of fact, the board of supervisors have adopted an order instructing the air pollution control district to set up a rule that would apply to trucks and buses at this time. That is in the process of being prepared. They have instructed the air pollution control district, in addition, to prepare an ordinance or a rule that will provide some type or kind of an air control, contaminant control device on all automobiles within a year.

Now, that rule was adopted—that resolution was adopted in January or February, so early in 1957 we will have fairly complete control of all of the automotive equipment in the county of Los Angeles.

Mr. ROOSEVELT. Now, let me just get that straight in my mind.

By 1957, every truck, bus, and automobile in Los Angeles County, by direction of the board of supervisors, will have a control unit installed or not be allowed on the road?

Mr. WILL. That is about the way it works out now. That is about the timing of it.

Mr. ROOSEVELT. That is news to me. I am glad to hear it.

Mr. WILL. Now, I have a few figures to follow through with the original idea of where the Federal Government would fit into this picture.

The County of Los Angeles Air Pollution Control District has been in operation for 8 years. The first 6 or 7 years were entirely devoted to research. A year and a half ago, we strengthened the enforcement program to enforce all of the rules and regulations that had been adopted.

I can only give you the results of that, but in the first 7 years of operation of the air pollution control district, there have been some 700 or 800 cases brought to court for violations. In the last year and a half, there have been approximately 30,000.

The enforcement program is well under control, insofar as we have rules for them to enforce. We recently had a decision in an air pollution control district case by the United States Supreme Court in which they would not rehear a case that had been tried in the local courts.

Now, in that period of time, the air pollution control district has spent $9,320,000 and in this coming fiscal year, 1956 and 1957, we have appropriated $4,556,000 for the operation of the air pollution control district.

A large portion of that will go into your actual scientific research; some of it done by us, some of it done by direct contract with large universities, some of it done by industrial and chemical firms as far east as New Jersey.

In fact, we are not barring anything. If we find a program that can be—think can be—of benefit to us, we are following through on it.

Now, this $9 million that we have spent and the $4,500,000 we are going to spend next year has been contributed by the citizens of this county directly to this effort and whatever is done is of value not only to Los Angeles but to every other large metropolitan community in the world, and this money has all been paid by the citizens of Los Angeles County, and a large proportion of it has come from the small-business men and hotel proprietors, the apartment-house owners and so forth.

The State of California has contributed to their budget for the next fiscal year $550,000, all of which will be spent on health research, the effect of air contaminants on public health.

Mr. ROOSEVELT. Do you feel that that is a proper proportion of State funds as against Federal funds?

Mr. WILL. No, not at all.

Mr. ROOSEVELT. In other words, you feel that the State has an additional obligation——

Mr. WILL. That is right.

Mr. ROOSEVELT. Which they have not exercised?

Mr. WILL. That is right; and let me further indicate to you that what we spent jointly, Federal, State and county, is a small amount as compared with the amount that is spent by business and industry in actually tailor-making devices to correct emissions from their own plants.

Now, we estimate in this area $40 million has been spent by industry, large and small plants, in putting in control devices.

Much of it is engineering research as it is made, and this is a contribution to every industry in the world where this problem occurs.

Now, the Federal Government has given us a considerable amount of money.

Mr. ROOSEVELT. May I ask you a question? Has the board of supervisors, again exercising their public powers, secured copies of all the results of these investigations?

Mr. WILL. Yes, sir, we have. We also approve all of the plans and specifications that are made for the development of devices that go into plants so that we have all of that information on file.

Mr. ROOSEVELT. Is it your opinion today that the machinery exists which, if put into effect insofar as plant manufacturing and industrial concerns are concerned, would effectively control?

Mr. WILL. In most instances, I would say "Yes."

Mr. ROOSEVELT. Do you feel that it is being completely enforced; I mean, have they been installed in all of industry?

Mr. WILL. Insofar as we possibly could get them to install them at this time.

Mr. ROOSEVELT. What keeps them from getting them installed 100 percent?

Mr. WILL. Some injunctions have been granted by court. Some trials have been carried out. There are some problems that are just defying science. We haven't been able to develop it.

Mr. ROOSEVELT. But you just said, Mr. Will, that you felt in the vast majority of industry that you had solved the problem of machinery which would control. Now, this question——

Mr. WILL. These are install devices I am talking about——

Mr. ROOSEVELT. Install devices?

Mr. WILL. In operation.

Mr. ROOSEVELT. Have you then insisted that similar devices be installed 100 percent in all of industry that could be affected by those devices?

Mr. WILL. That is right; and before they can get a building permit, they have to get an approval from the Air Pollution Control District in order to build their plant.

Mr. ROOSEVELT. Is it your testimony before this committee that every new industry must have them installed and——

Mr. WILL. That is right.

Mr. ROOSEVELT. That they must be operated, and——

Mr. WILL. That is right.

Mr. ROOSEVELT. You are satisfied that 100 percent of enforcement takes place in Los Angeles County?

Mr. WILL. Well, insofar as we have devices that will control contaminants.

Mr. ROOSEVELT. But you just testified that you had a device which controlled by far a great majority.

Mr. WILL. That is right.

Mr. ROOSEVELT. So that it would be only a small part that didn't have them?

Mr. WILL. We think so.

Mr. ROOSEVELT. You are satisfied that enforcement is 100 percent of that vast majority?

Mr. WILL. Well, I don't want to exactly perjure myself.

Mr. ROOSEVELT. I hope you won't. I don't want you to.

Mr. WILL. I would say that insofar as it is humanly possible for us to visit all of these plants and get the complete cooperation of the owners and operators of the plants, that we find ourselves in that kind of a situation.

Mr. ROOSEVELT. Do you only insist where you get cooperation——

Mr. WILL. Oh, no.

Mr. ROOSEVELT. From the owners and from the operators?

Mr. WILL. We close down the plants when they don't carry it out.

Mr. ROOSEVELT. You close down all plants that don't comply?

Mr. WILL. Any plant that doesn't, we have closed them down, if they have not come in time.

Mr. ROOSEVELT. In other words, you are satisfied that the enforcement features today of the local law are sufficient and satisfactory, because today installed devices are insisted upon in all areas where they could or should be effective.

Mr. WILL. That is right.

Mr. ROOSEVELT. I didn't mean to interrupt you. Please go ahead.

Mr. WILL. Well, the only other point that I wanted to make today was that, if I might, that we know that we are in a very difficult area, and that the area is one that in addition to the fact that we are still rapidly growing, despite smog, growing at the rate of around 250,000 persons annually, with an increase in manufacturing plants of 1,000 to 1,500 new ones every year of possibly rather large plants and possibly 700 or 800 expansions per month, or 7,500 expansions a year in already existing plants, this despite smog, we are just gradually

reaching a point where, like other communities, we are going to run out of air completely soon, completely, whether it has got smog in it or not.

VOICE FROM FLOOR. No fooling.

Mr. ROOSEVELT. No comments, please.

Mr. WILL. Now, we think at this time that the most valuable feature of the Federal contribution has been directed toward the public health program. We think that any deletion of those appropriations would be very unfortunate.

We think that Congress should do everything that it can to utilize that fine service, the Public Health Service, through contracts with various scientific organizations and its own laboratories, to the end that some definite understanding of the actual public health problem as it relates to smog could be found.

Mr. ROOSEVELT. Mr. Will, if I may ask you a question at that point: I can understand the Federal Government helping and assisting in establishing the fact that smog is a danger to health. I am now convinced that that has not already been fully established, and we will hear more testimony on that.

However, no matter how much money the Federal Government should spend in establishing the dangers of smog, it doesn't do anybody any good unless the local authorities then do something about it; is that correct? [Applause.]

Mr. WILL. That is correct. I agree.

Mr. ROOSEVELT. Now, you have testified before this Committee that the industrial control is available in a vast majority of cases.

Mr. WILL. That is right.

Mr. ROOSEVELT. Now, if the industrial control of smog is already available and you have testified the next big step that is necessary for control is a device that will control trucks, buses and automobiles——

Mr. WILL. That is right.

Mr. ROOSEVELT. And that, you feel, is perhaps not available——

Mr. WILL. That is right.

Mr. ROOSEVELT. Would it not be more intelligent for the Federal Government then to spend its money and saying, "Here is a device," and then it is up to you to put it to work?

Mr. WILL. Wonderful.

Mr. ROOSEVELT. Why then is it not more important to stress that, than to spend thousands more dollars to establish something that is pretty well established?

VOICE FROM FLOOR. (Unintelligible comment.)

Mr. ROOSEVELT. We must have order at this hearing. We cannot have comments from the audience.

Mr. WILL. Mr. Roosevelt, my only comment at the beginning was relating to the automobile and truck situation that I am convinced, as I think most of our people who have been back to Detroit and gone through their program there, that they have been doing about everything they can do to find a device that will be within the reach of the average automobile owner to be installed on an automobile or a bus or a truck to assist in its operation and reduce—it may not completely eliminate it, but reduce at least, the contaminants that go into the air.

Now, there is an entire industry, if I may just follow this through, working on that at the present time. My own personal opinion, and

I may be entirely wrong, but my own personal opinion is that they are better equipped than anybody else possibly to accomplish this, and they are working at it, and they have announced their intention to continue to work on it. They have appropriated special amounts of money.

Now, we are gradually calling their attention to every suitable device or every reasonable device that we think should be investigated, and we are investigating it ourselves.

Mr. ROOSEVELT. They have been doing this for how long?

Mr. WILL. They started to work on this about 5 years ago.

Mr. ROOSEVELT. Would you not say that perhaps it was the responsibility of the Federal Government to step in at a point where they have taken up so much time without coming up with a solution to let somebody else come up with the solution to the problem?

Mr. WILL. That would be fine.

Mr. ROOSEVELT. Let me put the question this way: Is it within your knowledge as to whether or not today there exists a device that could be installed in new automobiles at, let us say, a cost of less than $100?

Mr. WILL. Now, there is a question I would prefer that you would ask Mr. Griswold.

Mr. ROOSEVELT. All right.

Mr. WILL. I know there is a device that has been tested relating to buses and trucks, which would be totally impractical from the standpoint of size to put on the average automobile.

Mr. ROOSEVELT. Well, we will ask him that in detail.

Now, if a device were available, would it not be a reasonable program—lacking any other program—to see that every new bus, truck, or automobile should have this installed?

Mr. WILL. Yes, sir.

Mr. ROOSEVELT. And assuming that every car turns over roughly every 3 years, which I believe is roughly the accurate figure, at the end of 3 years you would have eliminated the vast majority of all of the trouble that comes from automobiles; is that correct?

Mr. WILL. That is right.

Mr. ROOSEVELT. Therefore, is it not the proper thing to investigate the creation of such a device immediately and then to have the board of supervisors insist that legislation or police power be used to enforce its installation?

I can assure you of one thing from our own study: that the elimination of such things as phantom freight charges and things of that kind would more than absorb the cost of automobile companies of installing this in new automobiles, so it is not a question of penalizing the person that is going to have to buy an automobile. That can be absorbed if they want to do it, and if you insist on their doing it. If you, as the board of supervisors, insist on it, I think it can be done.

Now, the question is: Should the Federal Government spend its money and its effort in creating a device, so we can say to you: "Here is a device." If they don't come up with their own device within a limited period of time, then it seems to me that maybe the Federal Government could help in creating the device.

Mr. WILL. You certainly will have no objection from anyone in this county, officially or otherwise.

Mr. ROOSEVELT. I don't want objections. I want assistance, some positive assistance.

Mr. WILL. You certainly will get it. Any time that we can get a device that can be installed on anything that we believe, as far as I am concerned, will reduce the emissions 50 percent only, we would be glad to do something.

Mr. ROOSEVELT. All right.

Mr. SHEEHAN. Mr. Will, just to clear up in my own mind: I am not sure of where the—what shall I say—the responsibility of the city ends and the responsibility of the county begins. I would like to ask you these questions.

Mr. WILL. There is no responsibility on the part of the cities at all.

Mr. SHEEHAN. There is none at all, so that the county controls it?

Mr. WILL. It is all county. If anybody is wrong, we are at fault.

Mr. SHEEHAN. Therefore, any particular law or rule which you might pass would automatically control the city so that no one but the county would be responsible?

Mr. WILL. That is right, perfectly right.

Mr. SHEEHAN. I just want to get that straight so I would have no question in my own mind.

There is no divided responsibility on enforcement, in other words?

Mr. WILL. That is right.

Mr. ROOSEVELT. Would you yield at that point, Mr. Sheehan?

Mr. SHEEHAN. Yes.

Mr. ROOSEVELT. You assume that responsibility, however, because of a State law; do you not?

Mr. WILL. That is right.

Mr. ROOSEVELT. So the law is established by the State and they operate under the authority given to them by the State legislature?

Mr. WILL. There could be a district formed, if I may inject, that would include more than one county.

Mr. ROOSEVELT. I was just going to ask you that.

Mr. WILL. Or less than one county.

Mr. ROOSEVELT. Are you satisfied today that this authority can best be organized by an authority set up just within the county or would it not be wise on a State level to have the State examine whether or not the new form of authority taking in adjacent counties——

Mr. WILL. That is right.

Mr. ROOSEVELT. Or wider jurisdiction cannot be set up?

Mr. WILL. We have had considerable discussion and there have been bills introduced in the State legislature, some at our request, to set up what you would call a regional district control with State supervision as well as local supervision.

Mr. ROOSEVELT. So that this State legislature does have a responsibility to review the law it set up under which you operate——

Mr. WILL. That is right.

Mr. ROOSEVELT. To see whether that is the best means of achieving the result?

Mr. WILL. That is right.

Mr. SHEEHAN. The next question I would like to ask you, Mr. Will, is, if you have the authority in the county which you say you have, do you have the machinery and the manpower to enforce it?

Mr. WILL. I think that as far as the enforcement is concerned, it will cover all of the rules that we have.

Mr. SHEEHAN. Well, but you don't quite have enough rules, apparently, to eliminate the problem.

Mr. WILL. That is right. There is no use writing the rule unless we get a device that will eliminate the problem, such as this automobile.

Mr. SHEEHAN. Assuming you could get the proper device to eliminate the problem, then you still have the facilities for enforcing in manpower?

Mr. WILL. That is right. Yes, sir. We have taken the attitude toward this air pollution control, as you can see by these figures, in one year you will spend half of what we have spent in five years.

Mr. SHEEHAN. $4,500,000?

Mr. WILL. Now, there has never been the slightest question of holding back from the Air Pollution Control District. If they could profitably use $20 million, I think they should have it.

Mr. SHEEHAN. I would say, Mr. Roosevelt, as an offhand observation, that as far as the county goes and the board of supervisors, they are spending already over $9 million and $4,500,000 this year, that their first problem is to find out where they are going and they now know where they are going, and it should be a limited time until you have a major solution. Would you say that is correct, Mr. Will?

Mr. WILL. We hope so, but I want to be sure you understand that no miracle has even been performed in this smog deal and we don't think there will be.

Mr. SHEEHAN. That is right, because—I mean, that in my own city of Chicago, as you public officials know, even though you eliminate as much as you can, you are never going to get 100 percent free pollution. There are always some problems arising.

Mr. WILL. That is right.

Mr. SHEEHAN. If you can get 90 percent elimination, you are doing a lot.

Mr. WILL. If we can get 50 percent, we think we are awfully lucky here.

Mr. ROOSEVELT. Do you have any questions, Mr. Prichard?

Mr. PRICHARD. No.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. Mr. Will, do you feel then that the control of the automobile exhausts would be a major factor?

Mr. WILL. A very major factor; yes.

Mr. BISCAILUZ. Then, the other sources of smog could be readily controlled after you controlled the exhausts?

Mr. WILL. Let me say there are two principal problems left. In each instance, these two problems deal with the personal effect, so to speak, of the people. One is open burning—rather, not open burning, but small single-chamber incinerators which we would put out of business on October 1, 1957.

Mr. ROOSEVELT. Does the county have the power to do that also in city areas?

Mr. WILL. Yes, sir.

Mr. ROOSEVELT. The county has an ordinance or has the rules which will go into effect——

Mr. WILL. That is right.

Mr. ROOSEVELT. By October 1957, and all incinerators in Los Angeles County will then be eliminated at that time?

Mr. WILL. All but the industrial big type incinerator, the multiple-chamber incinerator. In order to do that, every city must have a rubbish-collection program and they haven't got them and we are meeting with them all the time constantly driving on that subject. We have a meeting this Wednesday, with 66 city managers and mayors and city councilmen and engineers present.

Mr. ROOSEVELT. Do you have the authority to force them to set up such a system?

Mr. WILL. We just cut out incinerators today and they will have to have some means by which they can dispose of their rubbish.

Mr. ROOSEVELT. If they don't and refuse for one reason or another, what happens then?

Mr. WILL. We could collect the rubbish and charge them.

Mr. ROOSEVELT. Do you have the power to do it yourself?

Mr. WILL. Yes, sir.

Mr. ROOSEVELT. You are prepared, then, by that date you have mentioned to do it one way or another?

Mr. WILL. Yes, sir; by October 1, 1957.

Mr. SHEEHAN. I made an offhand observation before that I thought Los Angeles was quite a bit behind the time in permitting these incinerators to be used on an open basis because that is certainly a city or county function, whatever the case might be.

Mr. WILL. Yes. I agree with you. The city was not ready. The next step is to collect and dispose of all this rubbish. We have to have rubbish-disposal service, and the county is undertaking to buy rubbish-disposal sites and the sanitation districts, which are county functions, by working both with cities and counties, will handle the disposal in these rubbish-disposal sites.

It will all be land-fill operations and they are being bought by the county as recreational areas, and as soon as they are completed, they will be devoted to recreation, such as golf courses, parks, and what have you.

If they are in a city, they will be given to the city, if they wish them. Otherwise, we operate them as a regional problem.

We had objections like you would have when you want to locate any type or kind of thing which people consider to be a nuisance to the location.

We are now in the process of purchasing three large refuse-disposal centers at a cost of somewhere in the neighborhood of $7 million. These expenditures, gentlemen, are in addition to the amount of money spent in the Air Pollution Control District.

Mr. ROOSEVELT. Now, may I just pinpoint that: Is it not true that originally the reports to the board of supervisors indicated that most of the smog came from cities and in particular, perhaps the refinery area; that in recent years, as a result of research, it has resulted in the present conclusion that 60 percent roughly of the trouble comes from automobile, bus and truck emission and that the other 40 percent is divided between industrial activity and backyard incinerators?

Mr. WILL. That is right.

Mr. ROOSEVELT. However, until you solve the automobile end of it——

Mr. WILL. That is right.

Mr. ROOSEVELT. You still have not solved the big end of the stock from your present information——

Mr. WILL. That is right.

Mr. ROOSEVELT. From scientists' contributions?

Mr. WILL. That is what we think.

Mr. ROOSEVELT. Therefore, to go back to your original suggestion, is it not right that such Federal funds as might be used, instead of spending them on ascertaining that smog does hurt people from a health point of view, which I am personally convinced of, although we will take more evidence, should it not be spent on assuring by this October date that you also will be able to put into effect a device that will control that part of emission?

Mr. WILL. That would be fine.

Mr. ROOSEVELT. Is that not the emergency of the situation?

Mr. WILL. We think so, yes; anything to force the automotive industry to complete their research and get a device. We have told them that we are not interested in 100 percent eradication; at first, even a small amount would be very acceptable to the citizens of this county.

Mr. ROOSEVELT. Let me put it this way: I wouldn't settle for a small amount. I would settle for trying to get clean air.

Mr. WILL. The only extent is if they have a device, which we suspect they have now, that gives some reasonable assurance that we will get some reduction.

Mr. ROOSEVELT. Do you suspect they have a device now?

Mr. WILL. I am sure they have.

Mr. ROOSEVELT. Well, if you are sure, then perhaps it becomes part of our responsibility to locate it and bring it out into the open; is that right?

Mr. WILL. Yes.

Mr. PRICHARD. I should like to ask one or two questions, if I may.

Just to sum up your testimony, Mr. Will, if I understand you correctly, you do think that 60 percent of the smog problem comes from the automobile; is that right?

Mr. WILL. I would say that is a fairly close estimate for a layman to make.

Mr. PRICHARD. At the present time, there is no control of pollutants that the automobile throws off into the air?

Mr. WILL. That is right; all automotive transportation.

Mr. PRICHARD. Now, with reference to the remaining 40 percent, can you give us any idea what part of the 40 percent is caused by the powerplants?

Mr. WILL. By the powerplants, it is coming under a control in the same manner as other industry, and I would say that the powerplant emissions are not a large, serious menace.

Now, we have no control over city-owned powerplants or district-owned powerplants, such as the department of water and power in Los Angeles, but the department of water and power has voluntarily agreed to install devices for capturing any pollutants that go into the air before they go into the air in their stacks and in their equipment. They are doing that gradually.

Mr. PRICHARD. Mr. Will, what I am trying to get at is: You have divided the 100 percent now into 40 percent and 60 percent. We are talking about the 40 percent.

What portion of the pollutants which comprise the 40 percent come from powerplants?

Mr. WILL. I would have to refer that question to Mr. Griswold.

Mr. PRICHARD. Now, the next question I want to ask is: What controls, if any, is there over the pollutants that are cast into the air by the powerplants?

Mr. WILL. Over privately owned and operated powerplants, there is a complete control, and we have had meeting after meeting after meeting through the Southern California Edison Co. and other competing powerplants programs here, and they have finally agreed to install equipment that we have asked them to install.

Mr. PRICHARD. Now, Mr. Will, it has been my understanding, and you correct me if I am wrong, that with reference to the Edison powerplant, for example, down at El Segundo, there is no control at all.

Am I right or wrong about that?

Mr. WILL. There has not been, but I would like to assure you——

Mr. PRICHARD. At the present time. I am talking about it at the present time.

Mr. WILL. Yes, but they have agreed to install a proper type of equipment.

Mr. PRICHARD. By what date?

Mr. WILL. I can't give you the date.

Mr. ROOSEVELT. Where can the committee get the date?

Mr. WILL. Mr. Griswold.

Mr. PRICHARD. Let us go back to it then with reference to the 40 percent. We have the powerplants. We also have the petroleum industry.

Can you tell us what portion of the 40 percent is contribtued by the petroleum industry?

Mr. WILL. I can't but you can get that from Mr. Griswold.

Mr. PRICHARD. From Mr. Griswold?

Mr. WILL. Yes.

Mr. PRICHARD. You can't tell us what percentage of elimination there has been with respect to the petroleum industry?

Mr. WILL. No, but I can tell you that there has been a tremendous amount of elimination.

Mr. PRICHARD. That would hardly tell us anything, would it, Mr. Will?

Mr. WILL. That is right.

Mr. PRICHARD. Unless we get it in percentage, of whether a tremendous amount of elimination has eliminated 10 percent of the total problem or 15 percent.

Mr. WILL. Anything I would give you is a guess and Mr. Griswold would be able to give you what our scientific group would give you.

Mr. ROOSEVELT. Will you please tell Mr. Griswold to come fully prepared to give us these facts?

Mr. WILL. He is here right now. He is hearing this.

Mr. PRICHARD. Since Mr. Will refers the questions to another gentleman, I will defer any further questions.

Mr. ROOSEVELT. Mr. Griswold will be here tomorrow afternoon, so that will give him a little time to get the information together.

There is one other question which I would like to ask: Do you feel that there is any problem with relation to industry not being financially able to install these control devices? In other words, suppose that you said tomorrow morning, "By January 1, 1957, every industry

must have an approved type of control unit." Could they install it financially?

Mr. WILL. Yes, most of them that contribute to air contamination are in a position financially to do it, and we have been working out, as you probably know, an arrangement whereby such installation, the cost of such installation could be handled in their income-tax returns so that the cost of that installation could be spread over a period of time.

Mr. ROOSEVELT. So, in other words, the Federal Government has already made it possible to install it now?

Mr. WILL. That is right. That is right.

Mr. ROOSEVELT. Under the regulations and the rules that are set up, it is a fact that today some of this is done on a long-term, extended period; or have you already set a date by which every industry must have these devices installed?

Mr. WILL. That is right. As I said earlier, and I will repeat it, any plant that is built today, before it can get a building permit, must have an approval.

Mr. ROOSEVELT. What about existing plants; not new ones coming in and being built, but existing plants?

Mr. WILL. Wherever there is a device that we know of that will recapture contaminants, it is required that they do it now.

Mr. ROOSEVELT. Now?

Mr. WILL. If they don't we close them down.

Mr. ROOSEVELT. In other words, there are no industries in this county of Los Angles that have not installed these units if there is a known device which would stop their emission?

Mr. WILL. There are industries which either must install by a given date or within a short period of time close down.

Mr. ROOSEVELT. What is the farthest known date?

Mr. WILL. Just a period of time to install the device sometimes.

Mr. ROOSEVELT. What period is that?

Mr. WILL. Sometimes it would take 2 years, 2 or 3 years to make the installation throughout a large plant.

Mr. ROOSEVELT. Would you say that by the end of 1957 every existing plant will be fully installed?

Mr. WILL. I should think so; yes, sir.

Mr. ROOSEVELT. Because that would be important to the residents of the area to know that by 1957 this was installed. At that time, the machinery available for full enforcement could go into effect?

Mr. WILL. Completely.

Mr. ROOSEVELT. Completely?

Mr. WILL. Yes.

Mr. ROOSEVELT. So that if it was not enforced, it would be the public official responsible for this enforcement who would be answerable to the citizens of the area?

Mr. WILL. That is right.

Mr. ROOSEVELT. Are there any further questions?

Thank you very much, Mr. Will, for your presence before this committee.

The committee will now recess until 2 o'clock this afternoon, at which time we will reassemble.

(Whereupon at the hour of 12:25 p. m., the committee was recessed until the hour of 2 p. m.)

AFTERNOON SESSION

Mr. ROOSEVELT. The committee will be in order, please.

The first witness this afternoon will be Dr. Arie J. Haagen-Smit from Cal-Tech.

Will you raise your right hand, Doctor, and be sworn? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. HAAGEN-SMIT. I do.

Mr. ROOSEVELT. Thank you, sir.

Will you please give your full name and address to the reporter.

Dr. HAAGEN-SMIT. Arie J. Haagen-Smit, H-a-a-g-e-n-S-m-i-t, 416 South Berkeley Avenue, Pasadena.

TESTIMONY OF DR. ARIE J. HAAGEN-SMIT, CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIF.

Mr. ROOSEVELT. Dr. Haagen-Smit, before you start, I might explain for the benefit of everybody present that the committee by practice and custom, swears all of its witnesses except those who are public officials, and because of their position as public officials, they have already taken an oath of office which is considered to be binding upon their testimony before this committee.

Doctor, will you proceed, sir, in your own words? We are very happy to have you here, and I would appreciate it if you would tell us what you want to tell us.

Mr. PRICHARD. May I suggest that Dr. Haagen-Smit tell us very briefly something of his qualifications, and then tell us the prepared material that he has brought for us.

Mr. ROOSEVELT. I think that would be very helpful. Thank you.

Dr. HAAGEN-SMIT. I have studied in organic chemistry at the University of Utrecht, where I received the doctor of philosophy degree, and I have studied such subjects as the chemical, the plant, cause and influence of different chemicals, psychological active substances, and since about 1949 I have become interested in the air-pollution problem.

The reason for this was that in the first place, it bothered us, and in the second place, I believe that I was qualified to study the analytical side, because in my work a great deal of microanalysis is necessary.

Since 1949, we have come a great deal closer to the exact knowledge of what smog is. Of course, smog is something different to quite a number of people, but we had a task to separate the essential from the less essential, and I say "less essential" because there are cases where local nuisances are of importance, of course, but the main problem we have shown comes about in the form of the high oxidant which is present in the air, and this oxidant is produced in a reaction of sunlight on gasoline mainly and oxides of nitrogen.

The gasoline, we know, comes to a large extent from incomplete combustion from cars. It is released by the oil industry. The oxides of nitrogen come from all high-temperature combustion, be it gasoline, fuel oil or gas.

A problem like that creates some difficulties because in this photochemical process, ozone is formed. Ozone appears here in concentra-

tions of 20 to 30 times higher than is present in the country. An ozone is known to be a respiratory toxic agent, and so the air-pollution district has set up some levels.

Those levels are understood to be provisional, but a great deal more work has to be done before they can be accepted as representing the actual levels at which damage is done to the health.

We can simulate the smog in the laboratory by combining this ozone with gasoline and this has been very important for the study of the effect of the smog on animals, human beings, and also plants.

At our institute, Dr. Wente and Dr. Hall have shown that not only physical damage is caused on plants, but there is a deterioration of growth. Plants remain smaller. Work has gone on on tissue cultures on animals as well as plants' tissue cultures.

Dr. Kotin at the University of Southern California is carrying out fumigation of the ozone and gasoline mixtures on the small animals and he has been able to create lung cancer in those animals, although the concentration used in those animals were much higher than those present in the atmosphere.

Nevertheless, it gives us thought as to why and I think that the air pollution control district has had ample justification to ask for control of the hydrocarbon emissions and oxides of nitrogen.

This work has been on the way for some time in the oil industry and this has resulted in a reduction of nearly 50 percent.

The other major source is the automobile. It is still in the reduction—the reduction is still in the experimental stage, as you know. We recently had a demonstration of some eight devices, but it is obvious that they are in the experimental stage and that there is a great deal more to be done in the development, and this development can be done by private agencies, as it is being done now, but here again I think also the Government should step in.

We have the most excellent research and development organizations in the Bureau of Mines and in the Bureau of Standards, and I feel that they could be of considerable assistance, not only——

Mr. ROOSEVELT. Doctor, may I interrupt?

Do you know of any work being done today in the Bureau of Mines and Standards?

Dr. HAAGEN-SMIT. There is a relatively small project on the way under the sponsorship of the United States Public Health, but what I wanted to express is that this should be a full-scale investigation.

We should press this with a great deal of stress. The solution that we are looking for and which we want to have, we want to have in the relatively near future. There is a reason for this haze, because every year the area grows about 4 to 5 percent in population, and in air pollution, and so when we have a 50-percent reduction by adopting some device or the kind, in 10 years this has been completely neutralized and so we have to do more. We have to cope with the present situation, but also with the increase, and that is where this greater effort should be used.

Mr. ROOSEVELT. In other words, if we had a device which would eliminate 50 percent of the problem, it still wouldn't be the real answer, because over a period of years we would have caught up to the same amount as we are throwing into the air today?

Dr. HAAGEN-SMIT. That is right, and if we today have a device which controls 50 percent, it will not be introduced today. It takes a considerable amount of time until those things are actually applied.

Mr. ROOSEVELT. Dr. Haagen-Smit, Mr. Will, the executive officer for the board of supervisors, informed us that in his opinion, there existed such a device today that was known to the automobile industry. Have you heard of that?

Dr. HAAGEN-SMIT. There is only a device for trucks. There is a device which by burning the hydrocarbons gives quite satisfactory control, but this device, which is for trucks, cannot be applied in its present form to automobiles.

It is too bulky and there are other difficulties, and so since the automobile represents by far a larger project than the buses, I can't agree with that statement at all.

The catalytic mufflers are still in the experimental stage. We shouldn't forget that the after-burner devices of the type of the Clayton model does not reduce the oxides with nitrogen, which was the other partner in the system; and when we can accomplish a 90-percent reduction of hydrocarbon, we have gained, there is no doubt about it, but for a tremendous, difficult problem such as in the automobile, it would be better to be able to control both oxides with nitrogen and hydrocarbon.

This is a problem, the control of oxides of nitrogen, which was actually never looked into at the concentrations we are working on.

Mr. PRICHARD. May I interrupt at that point?

As I understand it, Doctor, is it a fact that most of the investigation that has been conducted so far has been with the hydrocarbon side of the matter, the sulfur oxides, but that no controls have been imposed, to your knowledge up to this point, on the nitrous oxides; is that right?

Dr. HAAGEN-SMIT. That is correct; and at the present time, any work that is being done is of an experimental nature. We know how to control it in the laboratory, but this is such an extremely expensive and uneconomical process that this has to be converted into a practical way of doing it.

Mr. ROOSEVELT. Dr. Haagen-Smit, this morning we were told about the rather unusual committee formed by the automobile industry.

Have you been cognizant of or in contact with any of the work that that committee has done or authorized?

Dr. HAAGEN-SMIT. I think you refer to the committee which is formed among the powerplants?

Mr. ROOSEVELT. No. Mr. Will testified that the automobile industry had formed for the second time in its existence a special committee.

Mr. PRICHARD. A joint committee.

Mr. ROOSEVELT. A joint committee of all of the automobile makers to produce a device which would solve the problem for automobiles, and I was wondering if you had any firsthand knowledge as to the work of that committee or the results of its works or what information, if any, you could give us about it.

Dr. HAAGEN-SMIT. No. I have no information. I know about the first committee of the coordinated research council, which had a similar purpose, only at that time, the emphasis was placed largely on improving the mechanics, let us say, of the automobile running.

In about 1 or 2 years, I believe that the automobile industry has found out that it was not as easy as it looked at first and that we most probably would have to have a control device on the muffler eventually, and I think that that is the reason of the second group.

Mr. ROOSEVELT. But you know of no device that this committee has discovered or has made any reports on as far as the scientific information is concerned?

Dr. HAAGEN-SMIT. No; none that is out of the experimental stage.

Mr. PRICHARD. May I interrupt, Mr. Chairman?

Mr. ROOSEVELT. Certainly.

Mr. PRICHARD. May I ask you this, Dr. Haagen-Smit: Is it possible to tabulate the various pollutants in a general way which constitute smog?

Dr. HAAGEN-SMIT. Yes; that is true. The Air Pollution Control District has done that. They have a very elaborate and a rather complete idea about the pollutants.

Mr. PRICHARD. What, in general, constitutes the pollutants?

Dr. HAAGEN-SMIT. The nitrous oxides, the sulfur oxides, the areosols, the dust.

Mr. PRICHARD. And what else?

Dr. HAAGEN-SMIT. Hydrocarbons.

Mr. PRICHARD. Now, let me ask you this: Has there been a variation from time to time during the 6 or 8 years in the proportions of those pollutants which have present in our air?

For example, just to give you an illustration, maybe in 1948 or 1949 there was 40 percent of hydrocarbons and in 1956 it might be 30 percent or 50 percent or some other percentage. Is that a correct statement?

Dr. HAAGEN-SMIT. I certainly think that what you want to bring out, I believe, is that we have a constantly changing problem.

Mr. PRICHARD. That is it exactly.

Dr. HAAGEN-SMIT. Now, in 1948, we started out with a situation where the oil industry was releasing quite considerable tonnage in material from simple evaporation. In the few years after that, those sources were largely controlled.

On the other hand, we have had a 5 percent, 4 to 5 percent increase in automobile traffic, and therefore, a 4 to 5 percent increase in the automobile hydrocarbons, and so forth.

This merely balances out, so we haven't made any progress actually in the control of hydrocarbons, because we are still waiting for the automobile recovery.

Now, this oxide of nitrogen is worse because there was no control at the industry. There is no control in the automobile and an increase of 4 to 5 percent a year gives you, in 5 to 6 years, 20 to 25 percent increase and we have shown that some of the smog symptoms are directly proportional to the products of oxides of nitrogen and hydrocarbon, so if both increase we have a condition which is worse than just a linear increase.

Mr. PRICHARD. Let me ask you another question along the same line: If we could go to work upon the sulfur oxides, for example, and completely eliminate sulfur oxide, would we still have smog?

Dr. HAAGEN-SMIT. Oh, yes.

Mr. PRICHARD. Would we still have the problem?

Dr. HAAGEN-SMIT. Oh, yes.

Mr. PRICHARD. Well, is it a correct statement to say, then, that we have to attack the whole problem and meet every aspect or phase of the pollutants in order to solve the problem?

Dr. HAAGEN-SMIT. I have no doubt about that. While at the present time we are mostly bothered by the oxides of nitrogen and the hydrocarbon, when we have solved that problem, the sulfur dioxides and the sulfur trioxides will have increased by that time so much that we have another problem on our hands.

That is the same as the dusts. We have to control every source that we can.

Mr. PRICHARD. All right. Now, in that same connection, Dr. Haagen-Smit, is it correct to say that these pollutants, although each come from a different stack or from a different portion of the total problem, when they get into the air they create a chemical reaction within themselves?

Dr. HAAGEN-SMIT. Yes, there is no doubt about that. We have shown that to be the case of the oxides of nitrogen and hydrocarbon and I think this is also true for the sulfur dioxide, which is eventually converted into sulfuric acid.

Mr. PRICHARD. Would it be correct to say that some stack which would emit a pollutant, which in and of itself would not be a serious matter, when that pollutant is combined with another pollutant in the air, it helps to create the total chemical reaction which produces what we call smog?

Dr. HAAGEN-SMIT. Yes. This is one of the difficulties. When we take the oxides of nitrogen, the toxic concentration is about 5 to 10 parts per mile. We have here in this area not much more than a half a part per mile, so we are way below the toxic level.

In hydrocarbon, most of them we can stand 50 to 100 parts per mile without any danger when they are there by themselves. When we have the combination, we have already eye irritation, lung damage, and maybe other effects.

Mr. PRICHARD. The thing I am trying to develop for the committee is, Dr. Haagen-Smit: We have a varrying problem, is that correct?

Dr. HAAGEN-SMIT. Yes.

Mr. PRICHARD. We have a problem that is occasioned by the fact that the communities have a varying problem and as a consequence, a half solution just disappears into thin air as soon as the community has grown a little bit?

Dr. HAAGEN-SMIT. That is true. I think that we should not use the total tonnage figures, for example, to describe the situation in Pasadena and in Lakewood. Those problems are different and this is very often forgotten.

Somebody who is living in Lakewood, he knows where his problem is coming from. On the other hand, in Pasadena, we have our own pollution, small, of course, but we have it from our neighbors, a considerable amount coming in both from industry and automobile pollution, so the problem is different for different places in the basin.

Mr. ROOSEVELT. All right. We not only have a changing problem, a problem which varies with the community and is different within different parts of the community, but we have a problem produced by

the combination of the pollutants which produces an entirely new element into the problem; is that correct?

Dr. HAAGEN-SMIT. That is correct. It is quite possible that one industry might produce a certain chemical and another industry another chemical, and somewhere at a distance, they may react and give, for example, eye irritation.

This is not typical for this area. There are some of those cases which have been found in the East. There was a case where one factory emitted bromine and chlorine and another styrene and together they gave the war gas, so you can have a combination of those, and that is exactly what we have and what gives us our major trouble, oxides of nitrogen and hydrocarbons, and the automobile produces both.

Mr. ROOSEVELT. All right. May I inquire about one thing more?

Regardless of whether the smog is toxic, I think we can all agree that it has reached about the utmost in concentration when it comes from the irritation standpoint.

Is there any immediate solution for the irritation side of smog that is apparent in what the air pollution control district, for example, is doing? Is here any immediate solution of the irritation problem?

Dr. HAAGEN-SMIT. The only solution would be to stop all emissions of hydrocarbons and oxides of nitrogen, and this would mean stopping a large amount of the traffic.

Now, this is, of course, practically impossible and I believe that in the end we have to come to a more satisfactory public transportation system. Now, of course, it is possible to develop a zoning program so that in the future we might avoid building up a dangerous concentration. The chances are small but it is worthwhile investigating and this is an extremely difficult problem where a great deal of naturological and geological studies have to be gone into, and I believe that a good start has been made by the air pollution control district, but here again, the Federal Government and the military government could help tremendously because this situation stretches out far beyond the border of the basin and even the State.

Every morning you can see at the beach how fine the pollution comes out and which I believe is called "feather water," if I am correct.

Mr. ROOSEVELT. Quite aside from that, what I am trying to develop and that which I want to ask you if I am correct in the conclusion is: The problem has grown to the point of intensity where something more concentrated than what we have been doing up to this point must be done in order to solve the problem; is that correct?

Dr. HAAGEN-SMIT. I believe that the only way we can solve this is by engineering research and development, and any way that can be stimulated, that will shorten the time that we have to suffer this nuisance.

Mr. ROOSEVELT. Well, would it be a correct conclusion to state, Dr. Haagen-Smit, that the only outfit that could handle it on the basis of the problem that exists would be something on the Federal level?

Dr. HAAGEN-SMIT. Well, this I think would go a little bit too far. I mentioned already about what private industry has done and that is quite considerable, and what the Bureau of Mines have been going along with, but the problem is so large and when industry comes up with some kind of device or control, as an industry we have to continue developing this to cope with the whole situation, and so, as I said, we are all extremely well equipped for doing just that kind of thing.

Industry might have or might be satisfied with a certain efficiency, but laboratories, such as the Bureau of Mines, they can continue working on this so we are prepared when the situation gets worse.

Mr. PRICHARD. Let me ask you another question: As I understand it, Dr. Haagen-Smit, the smog problem is caused by a meteorological phenomenon that we call an inversion,——

Dr. HAAGEN-SMIT. Yes.

Mr. PRICHARD. Which creates a kind of ceiling over the top of our community and thereby confines the polluted air to the size of a box so that as the ceiling comes down, the pollution becomes more concentrated. Is that a fair description of it?

Dr. HAAGEN-SMIT. I think so.

Mr. PRICHARD. Now, if the size of the box is determined by the basin in which Los Angeles sets, we are going to have to solve the problem by 100 percent purification of the air in order to beat the problem. Is that about correct? Otherwise, each new industry, multiplied along the ground, will pollute the air 5 percent or 10 percent apiece now instead of 50 percent and ultimately we come up to the same level of pollution inside the box?

Dr. HAAGEN-SMIT. That is correct, yes, which means that we have to continuously to do the engineering research and development to perfect our control.

Mr. PRICHARD. Has any study been made, Dr. Haagen-Smit, to discover some means or method of punching a hole through the top of the box, if you understand what I mean, so as to let the polluted air get out of the box?

Dr. HAAGEN-SMIT. Calculations have been made by the air pollution control district and other agencies and they have always come up with the answer that the energy necessary to punch that hole in the inversion layer is just beyond our means. It is too much energy that we have to put in to do that, and the reason for that is that we think the air is lighter than it actually is, and as a matter of fact, air is pretty heavy in a way.

A cubic foot of air would weigh about an ounce and if you make a calculation on the amount of air that you have to displace, this would be tremendous. Then, by pushing that air, there is, for example, friction and that absorbs also a great deal of energy, so everyone who has calculated it comes out with the same conclusion that it would be nice if we could do it, but it is impossible.

Mr. SHEEHAN. In other words, it would be easier to chop down the mountains?

Dr. HAAGEN-SMIT. Yes.

Mr. SHEEHAN. In other words, expand the box?

Dr. HAAGEN-SMIT. Yes; or move out of this area.

Mr. ROOSEVELT. I think we are getting into the realm of popular mechanics. Can we reverse it for a moment?

Would it be possible to get on top of it and spray it with some chemical substance to dissolve it?

Dr. HAAGEN-SMIT. I would hate to add some more chemicals to this.

Mr. ROOSEVELT. You think we have enough?

Dr. HAAGEN-SMIT. Yes.

Mr. ROOSEVELT. In other words, you have discovered nothing in the laboratories which would neutralize it or make it dissolve?

Dr. HAAGEN-SMIT. Well, we could neutralize it all right, but I am convinced that the cure would be worse than what we have now.

Mr. ROOSEVELT. It would set up something different?

Dr. HAAGEN-SMIT. Yes.

Mr. PRICHARD. What I was trying to develop was not the popular mechanics of the situation, but simply to discover and establish for the purpose of the committee that the ultimate solution, the ultimate immediate solution, as I see it, is not trying to punch a hole through the roof of the box but the ultimate immediate solution is the solution of what is on the ground. Isn't that about it?

Dr. HAAGEN-SMIT. That is right. That is right, yes.

Mr. ROOSEVELT. Along that same line, we of the committee received testimony this morning, and I don't know whether you heard it or not, from Mr. Will, that the industrial pollutants were under satisfactory control; that known devices existed to control it and that it was merely a question, therefore, of enforcing the installation which existed and which would be required of all future industrial plants that were erected.

From your scientific knowledge, are those devices sufficient to control the emittants that are put into the air from the industrial plants in Los Angeles?

Dr. HAAGEN-SMIT. I am not quite sure to which ones you refer.

Mr. ROOSEVELT. He covered the field. In other words, he said there were a few perhaps where devices were not effective, but by far the vast majority could now be conerolled by existing devices of all industrial plants that emitted things into the atmosphere. Do you agree with that?

Dr. HAAGEN-SMIT. I wish it were true.

Mr. ROOSEVELT. You wish it were true?

Dr. HAAGEN-SMIT. Yes.

Mr. ROOSEVELT. In other words, you don't think it is true?

Dr. HAAGEN-SMIT. No. For the dust control, for example, Bethlehem Steel and Columbia Steel has equipment available, but that is only from the stacks and Kaiser Steel, which by the way, is outside the basin, the equipment is available and will probably be installed in the course of 1957, but we have other problems and those are the sulfur dioxides from powerplant stacks and industry stacks and the oxides of nitrogen again at the industry stacks and powerplants.

Mr. ROOSEVELT. Controls do not exist for those?

Dr. HAAGEN-SMIT. There is no control at all for those and we are trying to find a control for that.

Mr. ROOSEVELT. In other words, the testimony we received this morning, I think as a result of your question, Mr. Prichard, which was directed specifically to powerplants, we were told this morning by Mr. Will that such controls existed and would be installed, unless I am much mistaken.

Mr. PRICHARD. I think Mr. Will's testimony was that he didn't know the answer to that one and that he wanted Mr. Griswold to answer that later.

Mr. ROOSEVELT. Oh, I see. Well, now, in other words, you are saying that as of now there is no existing machinery which could control the emissions from these powerplants?

Dr. HAAGEN-SMIT. That is right, and at the present time work is going on at several of the powerplant stations to find ways of doing that, but even the method isn't known, so we have to go further back. We cannot start at the engineering. We have to find a method and that is what I am doing at the present time at the Edison Co. We are trying to find a way of controlling both the sulphur dioxide and dioxides of nitrogen.

Mr. ROOSEVELT. Would it not be possible for the Federal Government working perhaps through other Federal facilities such as other powerplants, the TVA and areas of that kind——

Dr. HAAGEN-SMIT. I think so.

Mr. ROOSEVELT. To do some research work?

Dr. HAAGEN-SMIT. There is no doubt about it.

Mr. ROOSEVELT. In other words, we should not leave it all to private industry but also put the resources of the Federal Government behind such plants. We might even do it with the municipal plant here, too, if they have similar problems which I would judge they would have.

Dr. HAAGEN-SMIT. Yes; I believe this is a problem which concerns the whole Nation. We are burning fuel oil everywhere and the solution that we will come up with, I hope—Mr. Will was a little bit ahead, I believe. We haven't found a solution yet, but if we find a solution, again you have to keep on working to improve that and get the most efficiency out of it.

Mr. ROOSEVELT. In other words, they will come up with maybe 60 percent efficiency?

Dr. HAAGEN-SMIT. That is right.

Mr. ROOSEVELT. And we have to work for 100 percent efficiency?

Dr. HAAGEN-SMIT. Yes.

Mr. PRICHARD. With reference to this matter of solution, Dr. Haagen-Smit, it comes down to something like this, doesn't it; a stack, for example—well, let's use the illustration of the Edison plant down at El Segundo. It emits so many cubic feet of polluted material, whether you call it air or not, per minute and your problem will be to discover something which will restore to normalcy that amount of polluted air in the space above us here within the time limit of 1 minute.

Dr. HAAGEN-SMIT. That is the big problem. It might be interesting to know that the size of the problem out of one stack will come about a half million cubic feet of air per minute. You have to find some treatment for that air. If you can do it in a minute, you still have to collect that air in some area which is about as big as a city block and if it takes you a minute to accomplish the reduction, you need that city block. If it takes you half an hour, you will take 30 city blocks, so our problem is to accomplish this purification, let us say, in a fraction of a second so we can do it within a limited space.

We hope to find ways of doing that, perhaps catalytic ways, something of that nature.

Mr. PRICHARD. We interrupted you, Dr. Haagen-Smit. You were making an explanation from a prepared statement. Is it, that is, the prepared statement, that you have the same one which you supplied to me?

Dr. HAAGEN-SMIT. That is right.

Mr. PRICHARD. For the purposes of the committee, I would like to have the committee receive into evidence the prepared statement because there is considerable in the way of material there that Dr. Haagen-Smit so far has not covered, and I am fearful if we keep on at this rate we will keep only one witness here until tomorrow night.

Mr. ROOSEVELT. Without objection, the committee will receive the prepared statement.

(The statement referred to follows:)

THE AIR POLLUTION PROBLEM

By A. J. Haagen-Smit

Mass toxic effects which have occurred in London and in the Meuse Valley have stirred communities to look into the cleanliness of their air, and have brought the realization that nuisance effects, under unfavorable circumstances, may become toxic effects.

In the Los Angeles area the smog situation is, at least for the majority of the population, till in the nuisance stage. However, many feel that in addition to the unpleasant symptoms of eye irritation and odor, respiratory ailments are aggravated by the presence of pollutants, and there may even be long-range effects leading to lung cancer.

The most typical chemical aspect of Los Angeles smog is its ability to oxidize substances which, in pure air, are relatively stable to the action of oxygen. This so-called oxidant shows a maximum during heavy smog periods, and correlates well with manifestations of smog such as plant damage, eye irritation, haze, and intense rubber cracking. A considerable fraction of the oxidant consists of ozone, which is directly responsible for the excessive rubber cracking observed in the Los Angeles area. Spectrographic as well as chemical methods have definitely established the presence of ozone concentrations 20 to 30 times higher than those found in unpolluted air, where 1 to 3 parts per hundred million is normally found.

The occurrence of unusually high ozone concentrations during smog periods is due to the action of sunlight on organic material, mostly hydrocarbons, and oxides of nitrogen. Reaction mixtures of this kind give eye irritation and the type of crop damage characteristic of the Los Angeles area. Simultaneously, aerosols are formed, contributing to the haze due to smokes and fumes.

Ozone is a respiratory irritant, and the Los Angeles County Air Pollution Control District has set alert levels at 50, 100, and 150 parts per hundred million of ozone. At each of these alert stages well-defined measures are taken to prevent further buildup of the pollutants. However, more data must be obtained to establish the true significance of these preliminary levels in relation to public health.

The ability to create a smog atmosphere in the laboratory is of great importance for biological studies, and at several institutions work is in progress to study under controlled conditions the effects of these new toxic agents on animals, plants, micro-organisms, and tissue culture. In plant experiments of this kind Drs. Went and Hull demonstrated the retarding effect of artificial as well as natural smog on the growth of plants. This effect is noticeable before concentrations are reached which give direct visible signs of damage. Dr. Paul Kotin has been conducting a series of fumigation experiments with ozone and gasoline mixtures over a period of more than 4 years, and was able to demonstrate a significant increase of lung cancer in his experimental animals.

All these results provide justification for controlling the sources which are responsible for the emission of oxides of nitrogen and organic material. In the past few years considerable progress has been made in the reduction of hydrocarbon emissions at the refineries, and recently the automotive industry has been investigating the contribution of automobiles to air pollution. Automobile exhaust is an excellent source of smog-forming materials, for it contains not only hydrocarbon, as unburned or partially burned gasoline, but also nitrogen oxides formed during the combustion of the fuel. It has been shown by laboratory experiments that automobile exhaust, sufficiently diluted and irradiated, will cause typical smog symptoms on plants as well as eye irritation in human subjects.

Methods for the control of hydrocarbon emisions from automobiles are being developed, and one afterburner, suitable for use on gasoline buses or trucks, is already on the market. Devices suitable for passenger automobiles are still in the experimental stage, and only a few weeks ago the Air Pollution Control District sponsored a showing of the more promising devices. These included, besides the afterburners, devices which controlled the flow of gasoline into the engine, and effected a reduction in fuel loss by reducing the flow of gasoline during certain phases of automobile operation. It is obvious, however, that a great deal more work is necessary to control this phase of the problem.

The recovery of nitrogen oxides presents an even more difficult problem in that the methods of recovery must still be developed. Research in this direction is still in progress, and practical recovery installations will probably not be available for some time.

Today, most of the sources for which control devices are available are being controlled. Unfortunately, engineering research and development is still groping for a suitable answer to the problem of reducing same of the major sources of emission. This work is being carried out primarily by private industry, but in many phases of it Government research institutions can provide valuable assistance. Even after control devices have been adopted, there will be a need for perfecting the methods and the equipment. The spectacular growth of cities adds increasing amounts of pollutants to the air. In Los Angeles the growth amounts to 4 to 5 percent per year. Assuming that the growth rate remains constant, it means that when, after considerable expense, a 50 percent reduction in pollutants is obtained, the beneficial effect of such a reduction will be wiped out in 10 years by the increased pollution resulting from normal growth. At that time a further reduction will be more difficult and more expensive. We must therefore speed up the engineering research and development aimed at increasing the efficiency of our controls. This can be accomplished by thorough studies in laboratories especially suited for this type of work, such as our National Bureau of Standards, and the Bureau of Mines.

In our rapidly growing community new problems of air pollution are bound to arise. New industries, modifications of fuels, and possible replacement of these by atomic energy sources demand a continued analysis of the air and of its effect on living organisms. Some of the problems may be specific for this area; many are of a more general nature, such as those dealing with effluents of fuel combustion, which should be of concern to the Nation as a whole.

Mainly through the efforts of the Los Angeles County Air Pollution Control District, we possess considerable information on the nature and quantity of effluents from industrial and private sources. Also, their relative importance in the air pollution problem is well established. While, at the present time, emphasis is placed on the reduction of hydrocarbons and oxides of nitrogen, control of other known sources of pollution is continuing, for it is well known that pollution in the immediate vicinity of a minor offender—be it an incinerator, a bus or a small foundry—can be of considerable nuisance. The pollution over an area as large as the Los Angeles basin is not evenly distributed, and the tonnage of pollutants per square mile, as well as their nature, is different for each community. For areas in close proximity of major industries the sources of air pollution are rather obvious. This is not the case for cities such as Pasadena, which receives in addition to its own contribution from local traffic and incineration, a large share of pollution from its neighbors.

While control at the source of emission may be able to cope with the growth of the community, a knowledge of the distribution of pollutants and the prevailing meteorological conditions may help to minimize nuisance effects and even prevent the accumulation of dangerous pollutants in certain areas. For the establishment of an effective zoning program based on such information, close cooperation between governmental agencies, including the military, is highly desirable.

Air pollution problems result when more waste products are poured into the air than can be dispersed under normal conditions. As effluents from one source are controlled, others increase, and as the population increases more and more sources of emission are introduced. Only by constant vigilance can we cope with such a continuously growing and changing situation.

Mr. ROOSEVELT. My colleague has some questions which he would like to ask.

Mr. SHEEHAN. You stated that since 1949 you have now learned a great deal about smog. When has this learning taken place; has it been in the last year or 2 or 3?

Dr. HAAGEN-SMIT. Oh, I think in 1950 we knew the essentials.

Mr. SHEEHAN. In other words, it is only from 1950 to 1955 that anybody would have a chance to work on the necessary research and development to find out how to remedy the principle that you found causing the smog?

Dr. HAAGEN-SMIT. Yes; that is correct.

Mr. SHEEHAN. Did I understand you correctly to say that as yet there has not been sufficient research and development so that you can perfect the machinery to do that?

Dr. HAAGEN-SMIT. That is correct.

Mr. ROOSEVELT. 100 percent?

Dr. HAAGEN-SMIT. Yes.

Mr. SHEEHAN. Or even in any appreciable way?

Dr. HAAGEN-SMIT. Well, no practical way I mentioned, of course, the automobile devices and some control devices at the refineries but for the oxides of nitrogen and for the hydrocarbons coming from the exhaust of the cars, no satisfactory solution has been found.

Mr. SHEEHAN. For the refineries, they have it?

Dr. HAAGEN-SMIT. Yes.

Mr. SHEEHAN. What I am getting at is simply this:

The people in the Los Angeles area, insofar as the necessary development and research has not fully taken place, they cannot expect an immediate solution to this problem; is that right?

Dr. HAAGEN-SMIT. That is correct. There isn't any reason why this summer wouldn't be worse than last summer.

Mr. SHEEHAN. Then, would you say that the city officials and the county officials are at fault if they don't even know what the real solution of the problem is?

Dr. HAAGEN-SMIT. No; I think that that is not quite true. During the time that, let's say, a few years ago, the oil industry started recovering their emissions and they have gone quite a ways.

Now, at the present time, the total recovery is 300 to 400 tons but most of that is very difficult to catch and it comes from the oil fields where it is practically impossible to recover.

The Air Pollution Control District succeeded in getting the automobile industry interested and since about one and a half years ago, they have started their development in Detroit and some other corporation such as the Clayton Co. and the Olson Catalyst Co., they started working on the automobile device.

I mentioned some of the projects which the Public Health Service has contracted with the Bureau of Standards and the Bureau of Mines, so I think that it is a matter of degree rather, what we would like to see with the problem becoming more acute every year. I would like to see a speeding of the program and drawing in the resources of final accomplishment.

Mr. SHEEHAN. From a scientific standpoint, and you are speaking to us as an expert or scientist, when can the people of the Los Angeles area look forward to enough research and development plus the mechanical devices to make it useful so they can start to lick the smog problem? Will it be next month, 2 years or 5 years?

Dr. HAAGEN-SMIT. We can only make a guess.

Mr. SHEEHAN. What is your guess?

Dr. HAAGEN-SMIT. You can arrive on that this way; that a very important part is the automobile muffler. Suppose that at the present time a muffler would be improved, it would certainly take about half a year of road testing before the county could possibly recommend this big expense.

Then, this device has to be—the sale of such devices have to be enforced. They have to be made in large quantities so I think that certainly 2 years would pass before something like that would happen.

Mr. SHEEHAN. Two years after the perfection of a device?

Dr. HAAGEN-SMIT. Yes.

Mr. SHEEHAN. We haven't got a device yet.

Dr. HAAGEN-SMIT. That is right.

Mr. SHEEHAN. Would you want to make a guess as to when a device might be perfected?

Dr. HAAGEN-SMIT. It might be next year.

Mr. SHEEHAN. It looks like a minimum of 3 years before something effective might possibly be done?

Dr. HAAGEN-SMIT. I would think that would be a pretty good guess.

Mr. SHEEHAN. You mentioned quite a few times about the exhaust from the automotive cars and Mr. Prichard this morning tried to get out of Mr. Will a guess as to the percentage of pollution caused by various factors.

Is that right Mr. Prichard?

Mr. PRICHARD. Yes, that is right.

Mr. SHEEHAN. Would you care to hazard a guess as to how much of the smog irritant is caused by automobile exhaust in this area today?

Mr. PRICHARD. Let me interrupt. Dr. Haagen-Smit has already testified that at different times from 1949 to the present time there has been a variation in the percentages.

Mr. SHEEHAN. Because of the growth in the automobiles.

Mr. PRICHARD. Because of the growth in the automobiles and the controls that have existed with reference to certain elements of smog. So what I was going to say is: In all fairness, you should ask him the question as of a specific time.

Mr. SHEEHAN. As of today; as of now, in the smog problem what percentage, if you can arrive at a percentage, is caused by the exhaust from the automobiles in the area, the Los Angeles area?

Dr. HAAGEN-SMIT. Well, this question isn't well to answer because some areas are downwind of an industry. They will have 100-percent pollution from that particular industry.

Mr. SHEEHAN. I see.

Dr. HAAGEN-SMIT. And I mentioned Pasadena, for example. We have a mixed problem. We have our own pollution. We have the traffic pollution from Los Angeles and superimposed in that is that from the industry, let's say, south of Los Angeles, so what sense is there in saying that the total tonnage released by the automobile is 75 percent of that of the industry?

Mr. SHEEHAN. In other words, it is not ascertainable?

Dr. HAAGEN-SMIT. It is not ascertainable.

Mr. ROOSEVELT. It is a complete and rounded problem that must be attacked in its entirety?

Dr. HAAGEN-SMIT. That is right. What we should figure is the density of the pollution per surface. If you have a point source like an industry, downwind of that industry might be a lot more disagreeable than where we have a lot of automobiles cruising around in that area.

Mr. ROOSEVELT. I am a little disturbed, Dr. Haagen-Smit, by your prediction that the community of Los Angeles has to suffer for at least 3 more years.

In 3 years, a lot of things could happen. Would you feel that if what we used to call a crash program was put into effect to develop the devices for automobiles, improve the devices that exist today and establish the ones that are needed in such industries as the power industry that it could be accomplished in a considerably less period?

Dr. HAAGEN-SMIT. My 3 years is an optimistic statement unfortunately and that takes into account that you are successful in interesting the Federal support.

Mr. ROOSEVELT. My question was a hypothetical one. Assuming that the Federal Government would be interested and would be impressed enough with the dangers that exist for public health and other reasons so that a crash program was authorized, would you feel that the time could be cut down considerably?

Dr. HAAGEN-SMIT. Hardly.

Mr. ROOSEVELT. Hardly?

Dr. HAAGEN-SMIT. Hardly. I think if we work hard, all of us, we are fortunate if we get——

Mr. ROOSEVELT. If we don't get a crash program, it may be 6 years?

Dr. HAAGEN-SMIT. That is easily possible.

Mr. ROOSEVELT. I hope the chamber of commerce is taking notes.

Mr. SHEEHAN. We have a lot of space in Chicago.

Mr. PRICHARD. Dr. Haagen-Smit, is it a correct statement to say that the problem is becoming so critical that if Uncle Sam and all of us don't get busy and do something about it, the smog is going to eat us up?

Dr. HAAGEN-SMIT. Well, I don't think that is quite correct. As a chemist, I am not that much scared.

It is going to become so insufferable from a standpoint of sheer nuisance that it will produce a terrific damage to our community?

Dr. HAAGEN-SMIT. I think it becomes more obnoxious every year and I think that everyone should contribute by supporting a governmental agency.

Mr. ROOSEVELT. Dr. Haagen-Smit, my feeling as a result of your statement is, if we go in the normal course of events, it might be 6 years or longer?

Dr. HAAGEN-SMIT. Oh, yes.

Mr. ROOSEVELT. You say that even that is optimistic?

Dr. HAAGEN-SMIT. Yes.

Mr. ROOSEVELT. From what you say I think that if a crash program will take 3 years that this problem is not only important enough for this committee to investigate but it requires immediate action on the highest level within the State. It is a challenge to the State government to marshal all of its own forces within the State and then to secure the fullest cooperation from every Federal source available. Unless we are prepared to accept a very high ratio of loss in this area we had better get started.

Dr. HAAGEN-SMIT. I agree with that, yes, and I think that even if we have solved, let us say, in this crash program the present situation, you are going to get again problems.

Think of the atomic energy problem. Suppose we do change our normal fuel burning for atomic energy plants. Again you have a problem of the emissions.

Mr . SHEEHAN. We would have a new problem?

Dr. HAAGEN-SMIT. A new problem. What we have done on our food, we have to do for our air. It is exactly the same.

Mr. ROOSEVELT. In other words, we had a pure food and drug program for the food. Now, we had better do it for the air or we won't be able to eat.

Are there any further questions?

Mr. PRICHARD. I have no further questions.

Mr. SHEEHAN. No.

Mr. BISCAILUZ. No further questions.

Mr. ROOSEVELT. If not, we wish to thank you, Dr. Haagen-Smit, for your presence before this committee today.

Our next witness will be Mr. William H. T. Holden.

If you will come forward, please.

Will you please raise your right hand? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. HOLDEN. I do.

Mr. ROOSEVELT. Thank you, sir. Would you give your full name and address, please, to the reporter?

Mr. HOLDEN. My name is William H. T. Holden. I reside at 2042 Prairie Street in Altadena, an unincorporated community of Los Angeles County.

TESTIMONY OF WILLIAM H. T. HOLDEN, REGISTERED PROFESSIONAL ENGINEER, ALTADENA, CALIF.

Mr. ROOSEVELT. Will you please proceed, Mr. Holden.

Mr. HOLDEN. I am a registered professional engineer in the States of New York, California, and Arizona. I was graduated from Yale College in 1951 with special honors in chemistry and continued graduate work in chemistry for 1 year thereafter.

I was elected to Sigma Xi and to Alpha Chi Sigma because of this work. I continued in chemistry in graduate school courses in 1916, but shifted to physics and held the Sloane fellowship in that subject, in 1916 and 1917. After that, I was in the army and I attended Columbia briefly and went to work for Westinghouse Lamp Co., leaving in 1921 to go to American Telephone & Telegraph Co. in the department of development and research and, in 1934, I was transferred to the Bell Telephone Laboratories.

I retired from there at my own request in 1950 and have been in California since that time, engaged in the work of consulting electrical engineer.

I have been president of the State society of professional engineers and a member of the Pasadena chapter of that society and in that capacity, I have tried to do something with the smog issue. I am currently acting chairman of the State society's committee on air

pollution, our chairman, Dr. R. W. Sorenson, being absent in Europe.

Mr. ROOSEVELT. We are happy to have you, sir.

Mr. HOLDEN. That, I think, covers the qualifications.

Mr. SHEEHAN. He certainly should know something about the problem.

Mr. ROOSEVELT. He should; I think he does.

Mr. HOLDEN. When I lived in some of the eastern cities which I mentioned, such as Pittsburgh, New York, and Chicago, I was plenty well acquainted with the smoke situation in those cities.

The air in those cities, in Pittsburgh, particularly, and to a lesser extent in Chicago and New York, was filled at times with a black carbon smoke and it smelled rather badly from the sulfur and soft-coal burnings. Those cities cleaned up the air-pollution problem by a drastic restriction on the use of soft coal as a fuel and briefly they emerged into the sunlight, but today every one of those cities is experiencing at times of air stagnation a substantial amount of what may be described as hydrocarbon or Los Angeles type smog, and that arises from the large increase in motor vehicle traffic in those areas.

Now, that work which you have heard described by Dr. Haagen-Smit was a pioneer work on that phase of the air-pollution problem. That work was largely financed by the county of Los Angeles. Considerable additional work was done under other auspices, some of it with the hope of disproving, I believe, these findings but eventually the findings have been confirmed by every major laboratory that has investigated the thing and today I think we may say that there is no respectable difference of scientific opinion in regard to the hydrocarbon origin of one form or another as the cause of air pollution, the type that produces crop damage and eye irritation that we know so well here in Los Angeles.

Now, that hydrocarbon term is apt to cause a little confusion. As a matter of fact, it is not only hydrocarbons which are a particular class of chemical substances, but oxidation of products of those hydrocarbons ranging all the way from the aldehydes and ketones and aldehydes and carbonic acids, and any of those products may also take part in this smog-forming reaction.

The thing that is not known precisely is a matter of intense intellectual curiosity: Just what are these substances?

However, from the standpoint of getting rid of them, we know what we have to do and that is to keep these smog-forming materials out of the air. Now, those materials do not have a single source. They come from the automotive exhausts, as has been said, and they also come from the evaporation of organic solvents and paints, for example, and dry cleaning and from the losses in handling gasoline in transshipping it from the refinery to the bulk plant to the gasoline station to the tank of your car. They also take place around the refinery. They take place at the oilfields. They take place anywhere that hydrocarbon vapors can get away and they also come out in a difficult form, not necessarily as hydrocarbon but some of the oxidation products from the incinerator.

Once the stuff gets in the air, even though you don't know where it came from, it does the same thing to us when it is activated by the reaction with the nitrogen dioxides in the presence of sunlight. As has been described, it doesn't make very much difference where it comes from. We have to get rid of it.

Some rough estimates have indicated that if we are to get a substantial degree of relief, every source of air pollution needs to be reduced to approximately one-tenth of the magnitude that it had about a year ago. I haven't attempted to do this figuring lately and there has been some change in the contributions of a few sources.

Now, that is a very important point to bear in mind. No one of these remedies is the solution. The automotive one has been mentioned quite extensively in this testimony and its elimination is not the only thing that we need. We need other things as well, such as the elimination of incineration as a means of disposing of rubbish or incineration in the form of better types of incinerators.

Now, at that point, I would like to bring up an item in connection with possible Federal activities. There is no difficulty in getting the small manufacturer or the producer of incinerators or small-business men to undertake certain types of development. There is sometimes a question of whether he is financially competent to handle the thing on a production basis if he is successful, but the only kind of a product that you can get a manufacturer or a businessman interested in is one which has a market, a mass market. Now, there is a potential mass market for the automotive corrective device. Some of the people who showed such devices at a recent display here were small manufacturers and small-business men, but there is apparently a desire on the part of some people to wait until the auto industry has these things.

Now, the question is: Is the auto industry going to manufacture it themselves and push the small-business man aside, or is he going to be able to compete with the industry?

I think that is an important thing to consider.

Mr. ROOSEVELT. Do you feel that it might be worked out by the Bureau of Mines and the Bureau of Standards by getting them to cooperate?

Mr. HOLDEN. There is—I think so. There is an important point there in that there should be some agreed standard of production.

Mr. ROOSEVELT. I see.

Mr. HOLDEN. Different investigators are using different methods such as the photometer and the infrared spectrometer. You will find that this was true generally of air pollution associations last year.

Unfortunately, there is some discrepancy between the two methods. I think somebody not interested in the production or sale of either one ought to resolve those difficulties and differences and I think that the Federal Government through its Bureaus of Mines and Standards, and other agencies should establish agreed methods of tests, methods of measurement and manners of expressing results of these measurements on agreed units.

Mr. ROOSEVELT. Cal-Tech has not done that here or attempted it?

Mr. HOLDEN. Not to a great extent. They have attempted to standardize various methods of measurement, and outside industry is using methods which do not agree with theirs entirely. Consolidated American still uses another method and other companies use still another device, and so it goes. So I think that there is a need for some rather critical review and evaluation of these measurements and methods and a standardization of procedures. The method of handling the automotive exhaust role is also the same. You get a wide range of differences. The thing I would like to mention in connection with that is that there is no one source, no one faucet that you

can shut off to shut off smog. Likewise, there is no reasonable probability of any improvement by a change in fuel. That has been suggested from time to time that if we had a pure paraffin gasoline or some other kind of gasoline, we wouldn't have smog. You might have the suggestion that is based on the idea of taking the hydrocarbon out of gasoline, which is rather a neat trick if you can do it. There wouldn't be much gasoline left. There is actually a suggestion of even propane, which is a pure fuel and which does not itself form smog. After propane has been burned in an engine, the exhaust contains traces of propalene which is a very active smog-forming substance. You come out with smog-forming materials anyway regardless of what fuel you use.

There is a need of some evaluation of smog-forming capabilities of the various compounds that are present. Some of that has been done. I believe the county has supported some of that work, but I think the Federal Government should continue on it.

Now, I was also mentioning the unwillingness of some manufacturers to go into small quantity, high-cost developments. An example of that is the municipal incinerator or the commercial incinerator. Those are built-to-order jobs. They are large units. They cost in the order of a million dollars or a few times that. There has not been sufficient engineering and development to make those things satisfactory, with the result that we have the experience repeated several times in this area, and I am sure all over the country, of a city spending a substantial amount of money on a nice new municipal incinerator and the thing does not meet the requirements of the air pollution control district, and it was shut down.

Now, the cities are exempted by an unwise and ill-advised piece of legislation which we hope to see repealed, but in the meantime, no city is in a position to carry out that development on its own and there is no source to whom they can go and find out whether a proposed incinerator is any good or not. They listen to the most plausible salesman and buy it and sometimes it works but usually it does not.

The last point I wanted to bring into this is that the Federal Government might properly undertake the basic engineering and development. We do not need too much more of the pure scientific type of research that Dr. Haagen-Smit led in in regard to the origin of smog. What we do need is basic engineering development of a type that can be financed best by the Federal Government and not by manufacturers because of the very small return problem on the investment.

In control devices, I have attended these symposiums and other meetings and have read publications on smog. It is amazing how little there is in the way of the discussion of control equipment. To some extent, consultants and certain people are tending to keep that stuff confidential. It is a trade secret. That should not be permitted. It should be broadcast so that everybody can get the benefit of the latest knowledge as quickly as possible. If a man wants to get protection, of course, he is entitled to that, but I think the Federal Government are the only people that can afford to take on certain of these unpromising developments that are vitally needed in industry.

Now, a large part of the rise in automotive air pollution is attributable to the use of the automobile for local transportation. In

many communities, the automobile has become the primary method of local transportation, and as a result the local surface transportation systems are dying or operating in the red almost everywhere that they exist. Only in a few cities where rapid transit systems exist are those systems maintaining a satisfactory ratio of public acceptance. Chicago, incidentally, is one of those. It has been my suggestion to the Congress in connection with the Federal highway program to take steps to make it certain that the Federal highways when they approach metropolitan areas do not become overloaded and more or less useless by heavy volume of commuter traffic and by the provision of transport malls in the center, after the fashion of the Congress Street freeway in Chicago.

Mr. ROOSEVELT. Would you advocate that included in the highway program, possibly, there be Federal aid to the development of rapid transit systems?

Mr. HOLDEN. Yes, if necessary; certainly by provision of space in the freeway. I am not sure that any substantial amount of money beyond that would be needed except in central areas where you have to go into a subway where subway costs cannot be borne out of theirs.

In Chicago again, the subways were financed with a substantial amount of Federal aid being paid by the city over a very long period of time.

Mr. SHEEHAN. In our toll highway program we are making provisions for rapid transportation.

Mr. PRICHARD. In that connection, Mr. Holden, has there been some study made as to what is the ratio between one bus, for example, and how many automobiles one bus would supplant so as to reduce the amount of gasoline consumption and hydrocarbons cast into the air?

Mr. HOLDEN. Yes; I have made such estimates. They are rather in the nature of estimates and not guaranteed accountant-type figures, accurate to the last decimal point; but, roughly speaking, the average transit bus of the diesel type contributes about as much total air pollution, using Dr. Haagen-Smit's product of the oxides and hydrocarbons, as 80 automobiles.

Now, the average bus is on the street long enough to carry a lot more than 80 passengers so that a bus, if you can persuade the unfortunate public to ride these things, does reduce air pollution. It reduces it still more if it is electrically operated by a factor of about 5, but the surface vehicle is so slow that the public will not spend the extra time to ride them.

Rapid transit systems are faster than the automobile and that has the effect of limiting automobile usage to the peripheral area, the fringe area. People can park their cars in the malls and ride in. That has been demonstrated in a great many areas.

Mr. PRICHARD. Now that I have interrupted you and have gotten one question in, let me get another one in.

This same bus, if it has a device for picking up the pollutants which ordinarily would be cast into the air, would provide a considerably greater ratio, would it not?

Mr. HOLDEN. Oh, yes, if the bus were equipped with an afterburner.

Mr. PRICHARD. You have used the very word I was going to ask about.

In connection with these devices for eliminating the castoff of pollutants from an automobile, is a mere cutoff the proper device or an afterburner essential?

Mr. HOLDEN. It looks to those of us that have studied the thing as though the fuel cutoff alone would be of doubtful efficiency.

Let us assume for a moment that the automobile is contributing as much as 50 percent of the hydrocarbon in air pollution and the fuel cutoff has been estimated by those who like the device to be 50 percent efficient. Well, 50 percent of 50 percent is 25 percent. Gentlemen, you wouldn't notice a 25-percent reduction in total air pollution in this area. You would notice some improvement perhaps if the automobile contribution could be cut to perhaps 10 percent of its present value. The only device that appears capable of doing that is an afterburner. It has to have fuel cutoff, too, to prevent it from overheating under certain conditions.

We are inclined to believe that the good first step is to require the installation of fuel cutoff with the addition of the afterburners as soon as available. The afterburner involves some very serious problems. No existing equipment at the present time is acceptable. The only one available is a big thing for a 500-cubic-inch engine. It will be installed on gasoline buses operated by the Los Angeles Transit System, the LATL, as soon as delivery is made. There are two in service now. One has been on for about 3 years. The results have been satisfactory, very satisfactory, after the bugs in the initial device were overcome, but they had to have that background of 18 months to 2 years of road testing before they were happy with it. Now, they are going ahead with scaling it down to a 400-cubic-inch model engine, which has been produced. I don't know what the next step will be, whether it will be a 200- or a 250-cubic-inch size which will hit the passenger automobile.

Then, there is a diesel size by the same company. This is what I understand from discussions with them; that it would in theory, at least, reduce automotive air pollution.

Now, it is unlikely that any device would be completely as effective as these official tests, and so we may have to be satisfied with something a little less than perfection. We usually do.

Mr. PRICHARD. I notice that you are reading from a prepared statement there, Mr. Holden.

Mr. HOLDEN. I have added and ad libbed so much that this statement would be of little use to you.

Mr. PRICHARD. I was wondering if it contained the elements that you have not so far testified.

Mr. HOLDEN. It does. I have skipped much of it in shortening the testimony.

Mr. PRICHARD. Could you possibly give the original to the chairman?

Mr. HOLDEN. I would be glad to.

Mr. PRICHARD. It will amplify in some particulars, at least, what you have testified to.

Mr. ROOSEVELT. The committee will be glad, if it is all right, to take this as the prepared statement and your testimony as oral statement.

Mr. HOLDEN. I haven't signed that statement.

Mr. ROOSEVELT. That is not necessary.

Let me ask you just one other thing.

In addition to what the others have said to the committee, you have also added the element that we could do a considerable amount by trying to help a rapid transit system fairly quickly to be established in the area as one means of effecting at least some improvement.

Mr. HOLDEN. That would take about 3 or 4 years even if we start now. We won't be able to do that until enabling legislation is obtained in Sacramento this coming spring.

Even with that, the best we can reasonably foresee in the way of air-pollution-control devices is about that length of time.

There may arise emergency conditions here under which it would be advisable to halt the flow of passenger-car traffic not equipped with corrective measures. In the absence of adequate public transportation, that would be impossible. With such a system, it would be possible.

I don't believe rapid transit should depend wholly for its justification or even slightly on its relation to smog. It stands on its own feet.

Economically, it will mean a $300 million saving to the Los Angeles public, just as the existence in New York, the system saves the public $1,500 million annually. Nobody has ever translated those economic savings to the public and into cash in the pocket of the transit authority.

Mr. SHEEHAN. Mr. Holden, again, as I asked the last gentleman, I am wondering if you would give us any scientific guess as to when between the final culmination of scientific knowledge and practical application, Los Angeles might look forward to relief from the smog problem?

Mr. HOLDEN. I am afraid that it looks like a period of a minimum of 3 years and possibly much longer than that.

Consider this: Dr. Haagen-Smit is working on a program of developing control measures for power generating stations and other large thermal sources of heat.

Those devices don't exist today. Let us suppose that he is able to come up with a design principle in a few months. That design principle will then be translated into a prototype that will be built and tested and quite adequately tested, because it is probable that the cost of these installations will be several million dollars and you can't rush into an expenditure of that magnitude without being pretty sure.

In the same way in the automotive device, if a $10 device were required in every car in Los Angeles County, the public would be asked to spend $27 million. Now, I would not think that it would be a good policy to demand that without at least a separate and completely independent check of the findings as to the efficiency, et cetera, of the proposed device or devices to be approved.

If you are consulting a lawyer in a matter involving that amount of money, you would get the opinion of two counsel. If you were going to a doctor for a very dangerous condition, you would have a consultation of physicians.

In the same way, separate laboratory and technical investigations might be advisable in this matter. The county is doing some of that, The Federal Government can do more of it. Industry will do some of it.

The main point I would like to stress again to you and while I have a chance is that we in Los Angeles County have carried the expense for this air-pollution investigation and for much of the basic scientific work under the auspices of the Los Angeles County. We think most of that work is of general benefit to the whole world perhaps, and so many communities in the United States.

Much of the research development and even some of the engineering program now in the hands of the county might properly go to a Federal agency and in that connection, an interesting question which I perhaps shouldn't mention is whether or not the Federal Government should not compensate the county of Los Angeles for some of the expenditures it has made in the past.

Mr. ROOSEVELT. Please don't bring up that question.

Mr. Biscailuz, do you have any questions?

Mr. BISCAILUZ. I think it has been pretty well covered.

Mr. ROOSEVELT. Thank you very much, Mr. Holden. We certainly appreciate your appearing before us.

(The prepared statement of William H. T. Holden is as follows:)

STATEMENT OF WILLIAM H. T. HOLDEN

My name is William H. T. Holden. I reside at 2042 Crary Street in Altadena, an unincorporated community of Los Angeles County. I am a registered professional engineer in the States of New York, California, and Arizona. I was graduated from Yale College with the class of 1915 completing majors in chemistry and physics both, and was awarded special honors in chemistry. I was elected to Sigma Xi and to Alpha Chi Sigma on account of this work. I continued chemistry in graduate school courses in 1916, but shifted to the physics department and held the Sloane fellowship in that subject. I also completed senior electrical engineering courses with the class of 1916 Sheffield. After service in the Signal Corps and Air Service I attended Columbia for a short time, and then was offered work in the Westinghouse Lamp Co., at Bloomfield, N. J. I had been a summer employee at Westinghouse Electric & Manufacturing Co., in East Pittsburgh, before the war. I resigned from the lamp company in 1921 and went to work for the American Telephone & Telegraph Co. in the department of development and research, and when that department was transferred as a group to Bell Telephone Laboratories in 1934, I was included and remained there until 1950 when I secured retirement at my own request and moved to California to engage in consulting engineering work.

I had been a frequent visitor to California and to the Los Angeles area from 1934 onwards, as my parents moved here from Chicago in that year when my father, the late C. R. Holden, retired from the First National Bank of that city. Within 2 weeks after moving here permanently, I noticed a whitish haze that obscured visibility, caused eye irritation and smelled something like the inside of the Holland tunnel at peak traffic hours. On inquiring, I learned that this was smog. I have been trying to do something constructive about it ever since, mainly through the California Society of Professional Engineers, and the Pasadena Chapter of that society, with which I became affiliated in 1950. I was elected president of the State society in 1954 and served from June of that year to the following June, in that capacity. During this time I was asked to serve as chairman of a technical advisory committee to the Citizens' Antismog Action Committee, but withdrew from the group when it became evident that technical and scientific fact was to be ignored in favor of unsound and obstructive stands on air-pollution control if these stands appeared to be politically expedient.

I am acting as chairman of the State society's special committee on air pollution, as our chairman, Dr. R. W. Sorensen, is in Europe. I am also a member of the chapter committee headed by H. E. Karig.

While living in the eastern cities that I have mentioned, Chicago, New York, and Pittsburgh, and as a visitor in connection with my work in the Bell System to St. Louis, Cleveland, Philadelphia, and others I had firsthand knowledge of the smoke nuisance problem in these areas. For a time the office windows by my desk looked directly across the street to Pennsylvania Railroad piers, and

it was a frequent occurrence to find specks of black oily soot all over everything when a tugboat was working. We have all heard how the smoke problem in many of these cities was cleaned up finally and suddenly by forcing out the use of solf-coal fuels. But today these cities are experiencing a new form of air pollution, whenever they have a period of stagnation of air movements. Fortunately, these conditions are rare, though they are common here. They are getting Los Angeles type or automotive or hydrocarbon smog.

The pioneer work of Dr. A. J. Haagen-Smit which has been presented to your committee was financed in part by the county of Los Angeles. This basic and fundamental work on air pollution is used as a basis of attack on the problem all over the United States, and all over the world. While there may be some further problems on details, there is no respectable difference of scientific opinion in regard to the broad outlines of the photochemical reactions that convert hydrocarbons into smog in the presence of the oxides of nitrogen.

In addition to hydrocarbons as such, other chemical organic compounds may be similarly converted. In fact, the compounds inert to smog formation seem few and far between. Now, as far as smog is concerned, the origin of the organic material is immaterial. Much of its does come from automotive sources. Some comes from organic solvents as in paints, some from cleaning fluids, some from the organic compounds issuing from incinerators, and some comes from the evaporation losses of gasoline, or even from the crude oils containing the volatile fractions that are extracted as straight-run gasolines and other light fractions.

The important point that I wish to impress on the commitee is that there is no single source of the air pollution that leads to the formation of Los Angeles smog. There is no faucet that can be closed. Neither is there any possibility in a change in fuel. One of the more dangerous attempts to confuse and mislead the public in this respect is the agitation for so-called clean gasoline or white gasoline. It has been demonstrated repeatedly that there is no significant difference in the exhaust no matter whether nonleaded paraffin fuel or leaded olefinic fuel is used in an engine. There are some minor differences in evaporation products. Even when pure propane is used enough is cracked to propylene to cause some air pollution. Propane is one of the few hydrocarbons inert to the formation of smog, but the cracked product propylene is very active in this respect.

Different workers have used different methods of measurement and also in some cases different methods of expressing results. There are some discrepancies that appear to depend on sampling and measurement methods. A valuable service could be rendered in this field by independent high-level research on methods of test and measurement by one of the Federal agencies.

Another field is the development of standards of performance and methods of removing air pollution from large industrial and municipal incinerators. The vendors of equipment will and have undertaken work on small units for which a mass market may exist. Thus far, domestic incinerators appear to be built to meet price rather than performance if a recent article is taken at face value. But the possibility of a domestic unit free from air polluting output exists, and agreed standards of performance are needed. In the large municipal unit, or large industrial, there is no possible mass market and no probable return on investment in development by vendors, and no city can afford to finance such work, which would be of benefit to the whole country. This appears to be a proper field for Federal laboratory effort.

A large part of the rise in automotive air pollution is related to the rise in use of the automobile for local transport. This has been a cause of the gradual collapse of local transit systems sharing the street or highway with other vehicles. Where rapid transit exists and is faster than the automobile, it is holding its own or is showing an increase in public acceptance. The Federal highway program may be seriously impaired by the possible overloading of the sections of these highways within metropolitan districts, because of the possible flood of commuter traffic. The provision of rapid transit in central malles of such highways can do a great deal to relieve traffic on the road, and can move people faster and in greater numbers than can any use of the highway. It is strongly recommended that Federal-aid highways be provided with such central malles for rapid-transit usage, and that the use of Federal highway funds for this purpose be encouraged in all areas of sufficient total population and extent. This reduces air pollution, as the electric generating station can be controlled as a source of air pollution, and the lowered use of the automobile and the freeing of inner zones from congested automobile traffic eliminates or reduces a source of air pollution. The reduction in use of gasoline is beneficial in the air-pollution program from well to automobile service station.

I therefore urge the Federal Government to undertake a program of research and development on instrumentation and measurement of air pollution, on the development of large capacity remedial means that are sorely needed but unprofitable for industry because of limited demand, Los Angeles County has pioneered in much of this work, and it seems only just to our taxpayers that further work that benefits the whole country should be at Federal, not county or State expense. It might be advisable to consider taking over much of the work and the facilities of the county and even to compensate the county for past work. I also urge the assistance of the Federal highway program in developing rapid transit space on Federal highways in metropolitan areas, both as a means of relieving congestion on these highways and as a measure to reduce air pollution in metropolitan areas.

Mr. ROOSEVELT. The committee's next witness is Mr. H. Edmund Karig.

Will Mr. Karig please come forward.

Will you please raise your right hand? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. KARIG. I do.

Mr. ROOSEVELT. Thank you, sir.

Would you please give your name and address to the reporter, please?

Mr. KARIG. H. E. Karig. I reside at 4432 Woodleigh Lane, Flintridge, Calif.

TESTIMONY OF H. E. KARIG, CHIEF RESEARCH ENGINEER FOR THE WASTE KING CORP., LOS ANGELES, CALIF.

Mr. ROOSEVELT. Will you please proceed in your own way, Mr. Karig?

Mr. KARIG. I am a professional engineer, registered in the State of California. I am a graduate of the North Carolina State University with a bachelor of science degree in mechanical engineering. Most of my experience has been in the field of air conditioning and the handling of air.

I have been with the Carrier Corp. and Worthington Corp. in the east for some 10 years.

During the past 6 years, I have been employed as chief research engineer for the Waste King Corp. in Los Angeles. I am also now the chairman of the smog committee for the Pasadena chapter of the California Society of Professional Engineers. I have been doing some consulting work in the field of smog control and air-conditioning special devices.

Mr. ROOSEVELT. Thank you, Mr. Karig. Would you go ahead in your own words?

Mr. KARIG. I believe one of the major sources of air pollution in the Los Angeles area, or for that matter, in any large city throughout the country, is from the incineration of rubbish, either by the backyard type or industrial or municipal incinerators.

In the Los Angeles area the backyard incinerator, as we now know it, the single-chamber type will be soon outlawed and replaced by other methods of rubbish collection and disposal. This does mean that the sanitation district will have to collect and dispose of some 2,500 tons of combustible rubbish within the next, I believe, the next year, during the next fiscal year.

Present recommendations by the sanitation district are to dispose of this rubbish by land-fill methods. This is of the latest sanitary type. This is very efficient from the standpoint of air pollution. In fact, it is 100 percent efficient in that respect.

However, this will only suffice for perhaps the next 5 to 10 years. Then, after that, why, other means must be developed. The most logical, of course, is the municipal incinerator. However, there has been extremely little development work done on the municipal incinerator, and at the present time it is considered by authorities in this area to be inadequate for the disposal of rubbish in respect to control of air pollution.

In fact, I have been advised that the last real advance in municipal incinerators was back in England in about 1890, when this so-called multiple-chamber type was developed. Since then there have only been 1 or 2 research programs of a scientific nature undertaken, 1 by the Batelle Memorial Institute and the control of fly ash, and other by the Bureau of Mines and a small incinerator for disposing of radioactive matter.

Here again it is a specialized device that does not have enough application in industry to make it worthwhile for any one company spending considerable sums in development. My own company, for that matter, probably builds more incinerators than any other company in the country. They sell these in the form of small backyard gas-fired incinerators, and for that matter, it can be put in the home. There they have made several hundred thousand of them and it a mass production item and they are perfectly willing to put their own money into the development of such an item, but when they are approached on the development of a large incinerator they will ask, "How many can we sell a year?" and the answer is, "Well, perhaps at the most 10 or 20."

Well, that is not economically suitable as a product for any company that is in the business of making money, and that is what we are in business for.

Incinerators are going to be needed not only in Los Angeles but also in other cities. Los Angeles, I think, is somewhat fortunate. Land fill may suffice at least for 10 years, and perhaps further with adequate transportation of rubbish to the outlying districts and perhaps even development for disposing of it by grinding it into the sewers, which has been suggested, and which might prove even an economic advantage by recovering some of the waste product by sewerage treatment and the product in that case might be useful for agricultural purposes.

But the plea that I think should be made to the Federal Government is that this is not a local problem; it is a national problem. Disposing of combustible products by incineration is a national problem, and it is something that we feel the Federal Government should support by research program, either grant to a college or some institution that is capable and that will make the engineering factors and information available to industry so that they can use these factors in a design of an efficient incinerator from the standpoint of air pollution.

Of course, it would be the responsibility of the municipalities to include in any specifications that was given to private industry, the portable incinerator, the necessary devices to be controlled.

For instance, it is now specified in the Los Angeles area to—let's see. It is specified that the municipal incinerators must be, I believe, conform to a specification of 0.4 grams of a particular matter per cubic feet of stack gases.

Now, this turns out that it is nearly twice as efficient as half the quantity normally experienced in incinerators in eastern areas so we now have the most efficient incinerators in the country and still they are not satisfactory for air-pollution purposes. In fact, I understand out of 9 municipal incinerators that were in operation during the past year or so, 2 are now being temporarily, at least, abandoned, 1 by Beverly Hills and 1 by Alhambra, due to—well, first, economics and also it cannot meet the specifications.

Of course, I think it is the main reason why the municipalities have succeeded in getting their facilities accepted from the control district, the air pollution regulations.

Mr. ROOSEVELT. Because they were not able to meet the specifications?

Mr. KARIG. That is right; they were not able to meet the specifications, so we engineers, of course, are advocating that this rule be repealed and that the municipalities should be restricted and conform to the regulations.

Mr. PRICHARD. Is the reason for that, Mr. Karig, that if you simply pick up the rubbish from Mr. Private Property Owner and take it to the municipal incinerator and burn it, you produce the same smog problem; is that it?

Mr. KARIG. Practically the same. Let's say that you probably divide it up into finer particles, but there will still be excessive air pollution from the stacks of municipal incinerators.

It is now estimated—well, the total incineration from both backyard and municipal incinerators, I believe, is estimated at about 10 percent. However, this figure only includes the areosols and they state that the gases in organic hydrocarbon, ketones, aldehydes, and so on, are unknown, but some estimates have been made that indicate there are quite a large quantity.

Mr. PRICHARD. Will you just explain aerosol? That is the smoke element; is it?

Mr. KARIG. That is the smoke. It is both the solid particles, say, the dust, and also very small liquid particles, mostly of micromic size.

Mr. ROOSEVELT. In land fill, there is some dust and isn't there some burning which takes place?

Mr. KARIG. No burning. It is a cut and cover method. The bulldozers will first uncover the trench. The rubbish will be put in that trench and then the fill from the next trench will be used to cover that and, of course, it is crushed by the weight of the bulldozers as much as possible, but it is entirely a covering of the rubbish by several feet of dirt.

Mr. ROOSEVELT. Then, you thought is hand in hand with the other things presented to the committee, the research work should go on in relation with the problem in the investigations for large incinerators?

Mr. KARIG. That is right. In other words, the cut-and-fill method is only temporarily a solution in this area.

For that matter, in other areas such as New York and Chicago, it probably can't be used at all due to lack of land.

Mr. SHEEHAN. I have no questions.

Mr. ROOSEVELT. Mr. Prichard, do you have any further questions?

Mr. PRICHARD. No further questions.

Mr. ROOSEVELT. Mr. Biscailuz, do you have any questions?

Mr. BISCAILUZ. I have one question.

Then, in your opinion, incineration is the prime cause of our smog condition or just a segment of it?

Mr. KARIG. That is open to quite some discussion. According to the sources of air pollution as recorded by the control district, the particular matter of the aerosols, let us call it, from the incineration of the backyard, municipal, and industrial, actually composes 65 percent of that type of pollution.

Mr. ROOSEVELT. Do you mean by that 65 percent that all that contributes is but 65 percent of that type?

Mr. KARIG. Of that type, yes; and that type contributes mostly to the haze or, let us say, the poor visibility in the area. It is not the gaseous type, which I am referring to.

Mr. ROOSEVELT. It contributes not to the irritation but it is the blue smoke?

Mr. KARIG. That is right.

Mr. ROOSEVELT. It affects the visibility?

Mr. KARIG. Yes, mainly. It affects visibility at the present time, although there are some scientists and medical authorities who also feel that there is a phenomenon whereby gas is adsorbed on the surface of these particles and act as concentrators of these obnoxious gases when they are taken into the lungs and that is why we notice irritation from extremely small percentages of gas that medically should not be noticeable and it is mainly due to the concentrating gases on the small particles, and it is the belief of some authorities.

Mr. PRICHARD. What is the figure, Mr. Karig, if you know, as to the percentage to the total smog problem of the contribution of incineration?

Mr. KARIG. That is approximately 10 percent.

Mr. ROOSEVELT. Are there any further questions?

Thank you, Mr. Karig, very much. We are very grateful to you for coming down and being with us.

(The prepared statement of H. E. Karig is as follows:)

STATEMENT BY H. E. KARIG

One of the major sources of air pollution in any large city is the incineration of rubbish, either by backyard, industrial, or municipal incinerators. In the Los Angeles area, backyard incineration will soon be eliminated, and the sanitation districts of Los Angeles County will have to provide for the disposal of an additional 2,500 tons of combustible rubbish daily.

Present recommendations are to dispose this rubbish by landfill for possibly the next 5 to 10 years. This is a very efficient method for reducing air pollution, but in a metropolitan area such as Los Angeles, landfill sites are limited and do not represent a permanent solution.

Municipal incinerators, the most obvious permanent solution, is at present unsatisfactory because of the lack of incinerators designed to efficiently prevent emission of air pollutants. The APCD regulations for incinerators are only being conformed with by about 25 percent of the municipalities within the county using incinerators in general much more efficient than any in the country, and even these regulations are much more lax than the APCD would like. This is probably the reason municipal governments have obtained exception of municipal-owned facilities from the APCD regulations.

There have been no significant advances in the design of large incinerators since the development of the multiple-chamber type in England as far back as

1890. The only recent research on new methods have been some investigations on fly ash control by the Batelle Memorial Institute and by the Bureau of Mines for the AEC for burning radioactive waste.

Since most large cities throughout the country must resort to incineration, it would appear most appropriate for the Federal Government to support a strong research program for the development of more efficient and less air polluting incinerators.

Another possible method for the disposal of both garbage and rubbish is by grinding to the sewer. Before this could be seriously considered, many problems must be solved and special equipment developed. This is beyond the budget of any one municipality, but support now by the Federal Government would not only enhance the possibility of providing a sanitary and smog-free method of rubbish and garbage disposal, but also an economic source of fertilizer for agricultural purposes.

Mr. ROOSEVELT. Is Dr. Robert L. Daugherty present?

Dr. DAUGHERTY. Yes.

Mr. ROOSEVELT. Will you come forward, please? Will you please hold your right hand up? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. DAUGHERTY. I do.

Mr. ROOSEVELT. Thank you, sir.

Will you give your full name and address to the reporter, please?

Dr. DAUGHERTY. I will give you my card. I guess it will give the information.

(Whereupon a card containing the following information was handed to the reporter: R. L. Daugherty, professor of mechanical engineering, California Institute of Technology, Pasadena, Calif.)

TESTIMONY OF R. L. DAUGHERTY, PROFESSOR OF MECHANICAL ENGINEERING, CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIF.

Mr. ROOSEVELT. Will you please proceed, Dr. Daugherty?

Dr. DAUGHERTY. I am a registered mechanical professional engineer in the State of California and a former vice president of the American Society of Mechanical Engineers.

I graduated in mechanical engineering at Stanford University. I was an instructor in Stanford University and assistant professor in Cornell University, a professor in Rensselaer Polytechnic Institute, which is the oldest engineering school in the United States, and for the past 36 years I have been professor of mechanical engineering at the California Institute of Technology.

I have also indulged in a great deal of consulting engineering. For 3 years, I was employed by the Metropolitan Water District on pumping plants for the Colorado River aqueduct and for another 3 years I was engaged by the United States Bureau of Reclamation on the pumping project at the Grand Coulee on the Colorado River, which is the greatest pumping project in the world.

The Denver & Rio Grande Railroad also engaged me to improve the ventilation in the Moffat Tunnel, which is 7 miles long, the longest tunnel in the world in which coal-burning locomotives are used. Recently, I was consulted by the Great Northern Railroad with reference to the Cascade Tunnel, which is the longest railroad tunnel in the United States and the third longest, I believe, in the world.

I have also been engaged in a lot of other consulting work, although I am a mechanical engineer. Mechanical engineering is a broad field. One of my specialties has been fuel and combustion and steam boiler operation, and internal-combustion operation, and so on, the very topics which are very pertinent to air pollution.

Mr. ROOSEVELT. Dr. Daugherty, if you can get us out of this tunnel, you are doing all right.

Dr. DAUGHERTY. I don't know if this has any bearing on it or not, but from 1921 to 1931 I was the mayor of Pasadena.

Mr. PRICHARD. Before you get off your qualifications, would you tell us a little bit of what you have been doing as a member of the hearing board down there?

Dr. DAUGHERTY. Well, first, when the district was formed here for air-pollution control, each supervisor, of which there are 5, appointed a man from his district as an advisory member of an advisory committee, and I became chairman of that committee, so for 5 years, as chairman of that advisory committee, I became very conversant with the problems and work done and then a little over 2 years ago, I was appointed a member of the Air Pollution Control Hearing Board.

By State law, the hearing board must consist of 2 attorneys and 1 chemical or mechanical engineer, because the problems before the board are both legal and engineering, and in that capacity, from 3 to 4 afternoons a week I am hearing industries come forward and tell what they are doing to control pollution in their plants, what their problems are, what their difficulties are, and how long it is going to take them to find solutions, and I may say that some of them are having great difficulty in finding a solution regardless of how much money they will spend and are willing to spend.

It is difficult to find answers in many cases. In other cases, they know what their answers are. Invariably, they are willing to spend the money for it.

The hearing board has put several firms out of business, because they could not meet the financial requirements to solve the problem, and they simply had to sell out or close up the business.

Now, as to the problems, I wish to speak more particularly about the automobile. An estimate has recently been given that every 10 days there are 6,500 more people in this metropolitan area than there were 10 days before and every 10 days there are 3,000 more automobiles than there were 10 days before, and that means that the gasoline consumption in this area is going up at an increasing rate and is now approaching close to 5 million gallons of gasoline per day. That amount of gasoline will provide a volume of exhaust gas which atmospheric temperature and pressure would cover 1 square mile to a depth of 220 feet. I don't mean the air; I mean exhaust of that volume would cover 1 square mile to a depth of 220 feet.

So far, there can be no doubt that this is merely a matter of statistics that any engineer can make. Beyond that, there is a certain degree of estimation as to how much of volume of exhaust gas is bad and how much is not, but from all the tests that have been made and the analyses of exhaust gases, we may safely say that about one-half of 1 percent of that may be objectionable hydrocarbons and that would mean somewhere in the neighborhood of 1,100 tons of hydrocarbons per 24 hours.

Now, I have seen an estimate that the total amount of hydrocarbon liberated in this area by automobile, steam powerplants, heating plants, and office buildings and hotels, by the operation of refineries, by the distribution and marketing of gasoline and everything else, amounts to around 1,500 tons of which the automobile exhaust is 1,100 tons .

So the most important single factor in air pollution in this area is the automobile exhaust.

We may say, as you asked somebody about the percentage of it, that the percentage will vary from time to time and from one spot to another, but taking the county as a whole, 24 hours as a whole, I may say that the automobile exhaust is easily accountable for about 50 percent of the total irritating smog that we have in this area and it is very important that we do something about it.

Now, a great many suggestions have been made that if the automobile industry will only do something with their engine design, they would overcome it, and if the oil industry would do something about their gasoline and improve conditions, they would overcome it.

I want to speak on that subject. When the spark plug ignites the mixtures, there is not instantaneous explosion. The mixture burns from the spark plug to the other portion of the motor. It is the flame travel that is important, because if we have a high-speed engine, there is only a minute or a fraction of a second in which that combustion must be completed.

It is absolutely necessary that this flame travel with a high velocity. You can take any mixture of any fuel and any air and any proportion of the two and find the velocity of flame propagation through that mixture. This hasn't anything to do with an engine.

You might take a long pipe and ignite it at one end of the pipe and see how long it takes to travel to the other end. So it has nothing to do with engine design.

You can plot the curve velocity of flame propagation and find that the maximum point is a point where we have 10 to 15 percent less air than it is theoretically necessary to burn all the gasoline, so it is inevitable that in any satisfactory carburetor there is less air supplied than theoretically necessary.

Hence, it is inevitable that there will be incomplete combustion products in the exhaust. It is possible to burn any fuel completely or for all practical purposes. In the furnace of a steam boiler, we require for that purpose at least four things. There should be a sufficient quantity of air. That is like in the automobile. There should be a complete mixing of air and combustible material. The time element in the automobile is such that that has been altogether possible.

As it is in the furnace of a steam boiler, there must be sufficient time and there must be a sufficient high temperature. All four of those conditions can be met in the furnace of the steam boiler, so we can get complete, perfect combustion there. You can't get it in the automobile engine.

There is another side to that that leads to the same conclusion about the supply of air and that is this: We may say that we have our choice of two extremes, neither of which are feasible in practice.

One is to burn up all the fuel in the cylinder. To do that would require so much air; in other words, so lean a mixture that the engine

would have little power and acceleration and no driver would be content to drive that car a mile with that carburetor setting.

Furthermore, the flame travel would be so slow that the flame would actually become noticeable. The tail pipe of the automobile engine would overheat and be very unsatisfactory, but you might have complete combustion but that would be the only thing. That would be the only thing satisfactory about it.

The other extreme is to burn up all the oxygen in the air supply. That is more what we strive to do. We can put a few more drops of liquid gas in the engine.

The power of the engine is determined by the amount of air that is put in the superchamber. The power of the engine is determined and is dependent upon how much air can draw it. We strive to use all of the oxygen in the air which means that we have a surplus of air.

It leads us to the same conclusion. We get maximum combustion with a deficiency of 10 or 15 percent of air. Therefore, we are bound to have this incomplete combustion project which has nothing to do with the design of the engine. It is an inherent feature of combustion.

The other side is the nature of the fuel which has been spoken of. Many statements have been made that if the oil companies develop a proper type of gasoline, prewar gasoline, we wouldn't have any trouble.

Tests have been made in different parts of the country, in the East and other areas independent of this. They have shown, for all practical purposes, the character of the exhaust was practically the same, no matter what fuel was used.

Now, if the tests and theory do not agree, we can only conclude that 1 of the 2 is probably certainly incorrect. If the tests and theory both agree, we feel pretty reasonable that both of them are correct.

Now, the test shows that the exhaust is practically the same regardless of the fuel used, even if the fuel is propane, which people look to as the ideal fuel.

Any petroleum product which consists of six series of hydrocarbon is cracked; that is to say, these hydrocarbon compounds are broken down and reformed into different molecular structures of hydrocarbon by being subjected to high temperature and high pressure. That is what is done in the refinery. That is precisely what we have in the internal-combustion engine at the time of ignition. You have high temperature and high pressure, so the automobile engine is a good cracking device, and there are certain hydrocarbon compounds that are characteristic of cracked gasoline and it has been found that those particular hydrocarbon compounds are found in the exhaust of the engine when such compounds are not present in the gasoline being fed, even in propane, which proves the theory is correct, so therefore, we cannot hope for any improvement in engines or any improvement in fuels that is going to improve the air-pollution contamination.

We must, therefore, do something else. Now, some of the vilest products of combustion are given off during the deceleration period and in town driving, there is a great deal of deceleration. Almost every red light and every street corner results in deceleration, so there is a great deal of that and probably 50 percent of the exhaust-gas contamination arises during the deceleration cycle.

Now, the major automobile companies, General Motors, Chrysler, Ford, International Harvester, and a number of other small ones, have a joint committee that is working on this and they are endeavoring to

find some solution that is reasonable, commercially feasible, and whenever they find one, all the companies will use it together. Each one won't have their own.

These will be handled by cross licensing so they will do what they find to be the best. They have estimated that it will take about 2 years before they can tell about it. What the details are, they have not disclosed. I have heard some of the automobile officials tell about this program and work.

They are spending several million dollars on this study and in the meantime there are other people that are developing other devices that eight of which we saw recently displayed by the air-pollution control district at their offices and the control of emissions during the deceleration cycle will not completely solve the problem, so the complete solution will require some type of afterburner in connection with the muffler. That is even a more difficult problem to accomplish, but there are several devices now which are under study which give promise of being feasible in the future but not within the next year or two. It is not just around the corner.

Mr. ROOSEVELT. Do you feel that the seriousness of the problem justifies, however, greater effort than just the industry is making or do you think nothing can be gained in duplicating the work of the industry?

Mr. DAUGHERTY. I think a great deal of value would be gained by duplication, because the general public would be called upon to spend many millions of dollars for these control devices. I think it is unfortunate that it cannot come out from the air-pollution control district even if we as engineers were convinced that it is absolutely correct so it would be highly desirable.

We will say that the United States Bureau of Standards should arrive at similar conclusions.

I want to stress this: That what we are doing here in Los Angeles County is of value to the whole United States. Therefore, the rest of the United States should share to some extent in the financial burden of carrying on this work, and Mr. Will, by the way, made some references which I heard about powerplant controls this morning.

As someone who has had a lot to do about steam-boiler operations, both in classroom work and also in my consulting practice, I may say this: That although, as I testified a few minutes ago, you can have complete combustion of the fuel in the furnace of a steam boiler, that doesn't mean that the flue gases are wholly free from difficulty. For instance, there is sulfur in almost all fuel that is burned, even though there is less in fuel oil burned here than coal in the East, but there is still some here.

Therefore, a complete combustion involves the conversion of sulfur into sulfur dioxide. Now, the present regulations permit an emission of sulfur dioxide from any stack of two-tenths of 1 percent by volume. That is a very small amount, and from the standpoint of the chemist, if he has to work with that small percent to eliminate that, he has a difficult problem.

The test was made by the air-pollution-control district of the stack emission at the El Segundo powerplant of the Edison Co., which showed that the emission of sulfur dioxide there was roughly one-third of that two-tenths of 1 percent that is permitted, so that they are well below the requirements of the law, but the trouble is this: They burn

56,000 pounds of oil per hour and, although the percent of sulfur in their fuel oil is just about as low as can be had with any fuel oil in this area, that still permits about 1,200 pounds of sulfur dioxide per hour to be emitted.

Therefore, it is a sizable amount, even though it is very, very small in a percentage, and that is the very difficult problem.

Now, whether it is in a State powerplant or in the internal-combustion engine or in the household range in the kitchen, in burning any fuel, some of the oxygen in the air is converted into oxides of nitrogen. An excess of it is bad. No chemist on earth knows today what can be done with that oxide of nitrogen. They are already products of complete combustion, so it is a very difficult chemical problem.

That is one in which the Federal Government, through its Bureau of Standards or some other agency, might very well contribute. Again, that is not a problem peculiar to Los Angeles. It is also a problem in the whole United States.

The only difference between Los Angeles and the rest of the country is that we are more plagued with temperature inversion, which makes conditions worse.

If we had the climatic conditions that Chicago has, which is known as the Windy City, we wouldn't have much trouble. Also, I might state this: When you speak of sulfur dioxide, if Chicago—I am told this: If Chicago, Detroit, Pittsburgh, St. Louis, and other big eastern cities had the small amount of sulfur in their air right now as Los Angeles has right now, they would be delighted, so sulfur is not the most important problem.

I don't mean to say that we shouldn't get rid of it or minimize it, but it is not the most important problem at all.

Mr. SHEEHAN. At this point, do you want to say that Chicago is a good city to live in?

Dr. DAUGHERTY. From the standpoint of air pollution, perhaps yes, because of the winds they have there. If we had that breeze here all the time, we wouldn't have much trouble.

I want to say this: It has been mentioned before here in the talks made here that Pittsburgh has solved its problem and why doesn't Los Angeles solve its problem.

Pittsburgh's problem was relatively easy. It was obvious. It was black smoke or carbon from the burning of soft coal. That was obvious. Everybody knew that right at the start.

I am not saying that the problem was not difficult, but at least they had some clue as to what to do to solve it. Our problem is not that at all.

Our problems are much more intangible. They are much more difficult to determine and very much more difficult to find the answers to, and now that Pittsburgh and the eastern cities have gotten rid of the smoke, they have found now that they have another problem, because the smoke concealed it, so they are just beginning, so to speak, where we started in several years ago and so this is a nationwide problem.

That is why I feel the Federal Government can very well participate in it.

Mr. ROOSEVELT. Can I ask you a question at this point?

A good deal of emphasis has been placed upon the fact that this is a problem which has several component parts which should be worked out all the way around.

However, if we successfully attack the major component and were able to get a reasonable solution to it, perhaps not a perfect solution, but a reasonable solution, would it result in sufficient betterment in the condition to alleviate, in your opinion, some of the danger, the physical danger to health and other things?

Mr. DAUGHERTY. I am sure of that. I might state, Mr. Chairman, that I think the air-pollution-control district has made some wonderful strides in this area, but it has been completely masked; that whatever they did is wiped out by the increase in automobiles and the increase in population and the increase in the resulting industry.

There has been some question of whether the automobile exhaust was responsible for these figures that I have given, and these people say, "Oh, that is nonsense. We have smog on weekends when the industry is shut down."

People who make that statement do not realize that the oil refineries, the steel plants, and many other industries operate 24 hours a day 7 days a week. It would take them several days to shut down so they don't shut down.

Yet, it is a matter of statistics that on the whole we have less smog in the downtown area on Sundays than we do on weekdays. It is also a matter of statistics that the concentration of smog in the Los Angeles downtown area is almost the same on the days when prevailing winds come to us from the oil refineries as it is on other days when it is known that the wind currents don't come from the refineries or don't come in anywhere to Los Angeles, which again verifies the fact that the automobile exhaust primarily is responsible for our trouble here and not the industries alone.

I don't mean to say now that the oil refineries are entirely guiltless. They aren't. They make their contribution, but I can say that they are doing something about it, and in recent years they have spent, I am told, about $24 million, as a result of which they have cut down their emissions far below what they were some years ago and next year they will even still be lower, but they are making progress.

I can say that in my work on the hearing board, I am very much impressed by what industry is doing and industry is doing a lot, but we haven't done anything about the automobile exhaust except to get it worse and worse and worse every week, and we aren't doing anything about backyard incinerators. Every 10 days 6,500 more people are coming in here and burning that much more equivalent rubbish.

Mr. ROOSEVELT. Mr. Will did testify that there was a cutoff date.

Dr. DAUGHERTY. Oh, yes. We are going to do something about that, but so far we haven't.

Mr. ROOSEVELT. In other words, you will believe it when you see it?

Dr. DAUGHERTY. I recently saw a film called The City that Disappeared. A movie camera was set up overlooking Pasadena at daylight on a clear Sunday. Every few minutes it was exposed on the screen. In about 15 minutes, you could see what took place at hours at a time.

Shortly after daybreak from this distant point, you can see the various church towers in the city of Pasadena and Montebello with the hills in the distance. After a while, you could see a white plume

of smoke rise. You could almost tell where it came from. Another plume of smoke came up and another a half mile away. Then another and then another.

After a while, there was just a white haze over Pasadena and the city disappeared. That was on a Sunday purely from the smoke in backyard incinerators. There was no question about it.

The film was taken by the Research Institute and partially paid for by the Pasadena Chamber of Commerce.

Well, that I believe concludes my direct testimony. If you gentlemen have any questions to ask me, I would be pleased to attempt to answer them.

Oh, yes. Just a moment. I want to say that I agree as an engineer with everything that Dr. Haagensmit, Mr. Holden, and Mr. Karig have said before me. I agree with them wholeheartedly. If we differ at all, it is whether we talk about 50 or 40 percent, something like that. It is just a minor difference in estimation figures sometimes.

Mr. ROOSEVELT. Dr. Daugherty, you say that in your work with the control board that you had to put some industries out of business because they had not been able to financially adapt themselves.

In your opinion, is this a subject from the point of view of small business which we should investigate; in other words, would some of these industries have been able to do it if Federal funds were available to them on a long-term basis?

Dr. DAUGHERTY. Yes. I can tell you that just about a week ago one small-business man appeared before us. He had had a fire which burned out the plant. Insurance money did not pay for the restoration of the plant, so he had to borrow all he could and mortgage his own home. Then, he had to put in, in addition, some control equipment which would cost him $18,000. And he had gone to three bankers and had been turned down and he was then making application to this Small Business Administration for a small-business loan, and we had asked him how long it was going to take him.

He said he had a pile of papers this high [indicating] which he had to fill out and he was only part way through filling out all those papers. As soon as he got all of those papers filled out he could make the application. If that could be cut somehow or other, it would help.

We gave him a variance to continue operation to give him a chance to make his application.

Mr. ROOSEVELT. In other words, get through the redtape?

Dr. DAUGHERTY. To get some money from the small-business loans. He can continue in business and be in compliance with the law; and there are other people who told me they had spent money to the end of their resources, and they came to us to tell us that they had sold out or were liquidating their business because they couldn't finance it any more. Undeniably, there are a great deal of firms that could be helped out by the agency you mentioned.

Mr. SHEEHAN. I wonder if you would like to pursue the point which I have asked the other gentlemen?

I wonder if you would try to give us an educated guess as to when Los Angeles may look forward to conditions which we have in the great city of Chicago.

Dr. DAUGHERTY. Well, I can only agree with my predecessors in the witness stand that the automobile industry thought that in about 2 years they might have something which they would be ready to put

on the market; but, remember, if they came out with something today, it couldn't be put on this week.

Think how long it is going to take to put 2,500,000 of them on the 2,500,000 automobiles in Los Angeles County alone. If we turned all the mechanics loose on them, it would take them—I don't know how many months it would take them to do that.

When they bring out this device, it must be thoroughly proven and we must have legislation to require it. It is going to take a long time to do that.

Furthermore, if the device comes out and is proven and accepted, we then have to have some legislation that will make it compulsory, and there is a problem there. If Los Angeles County alone puts out such legislation, then what are we going to do about all these people driving into this area from just over the county limits?

It seems to me that this has got to be handled first on the State level so that it will be a requirement of the State law and, eventually, I would say, a requirement of Federal law, because that will help not only Los Angeles County but it would help even Chicago.

Mr. ROOSEVELT. In other words, we should make it standard equipment.

Dr. DAUGHERTY. Yes.

Mr. ROOSEVELT. One solution would be possibly to require it on every new car.

Dr. DAUGHERTY. Yes; just as we require headlights and taillights, that should be required on all new cars. Then it will also take a long time to get rid of the old cars. We have got to do something about them in a legal way. Otherwise it will do no good.

In the meantime, the problem is getting worse every week, because in this area we have the constant influx of population and the constant increase in contamination from all sources, not only automobiles but also from the incinerators and industry.

Mr. ROOSEVELT. Would it be reasonable to say that this problem justifies what we would call a crash program?

Dr. DAUGHERTY. I think so, yes.

Mr. PRICHARD. I would like to ask one or two questions if I may, Doctor.

You were here and heard the testimony of Mr. Will this morning; did you not?

Dr. DAUGHERTY. No, I didn't hear that.

Mr. PRICHARD. He implied that the district had been successful in producing substantially 100 percent elimination of smog by everything but the automobile.

Now, is that the fact?

Dr. DAUGHERTY. No, I don't think that is the fact at all. I think Mr. Will must have misinterpreted some information given to him. After all, he is not an engineer. I think he must have misunderstood or was answering some other type of question besides what he thought he was answering.

Mr. PRICHARD. You have indicated that there has been a variety of percentage figures given, but is it correct roughly 40 to 50 percent of the total smog cause, you think, is the automobile?

Dr. DAUGHERTY. Easily so, maybe 60 percent. I wouldn't quarrel with 10 percent one way or the other.

Mr. PRICHARD. The automobile consumes a hydrocarbon substance and casts off the residue of hydrocarbons into the air; is that right?

Dr. DAUGHERTY. That is right.

Mr. PRICHARD. Now, the petroleum industry in the manufacture of gasoline likewise uses, as I understand it, a part of the petroleum product as fuel for the making of gasoline.

Dr. DAUGHERTY. That is right.

Mr. PRICHARD. In other words, the first process that occurs is to crack the petroleum into two products: One product out of which they are going to make gasoline and another into a fuel they will put underneath this and burn to make gasoline.

Dr. DAUGHERTY. Yes.

Mr. PRICHARD. Now, the fuel they use, the hydrocarbon fuel, that likewise contains this sulfur dioxide; does it not?

Dr. DAUGHERTY. Yes.

Mr. PRICHARD. And it is, in turn, cast off into the air as the process of burning it to make gasoline?

Dr. DAUGHERTY. Yes, except the major refineries are collecting most of the sulfur compounds now and can convert that into pure sulfur and I wouldn't say all of it, but a great deal of it is now collected.

Mr. PRICHARD. Are they pretty efficient?

Dr. DAUGHERTY. Yes.

Mr. PRICHARD. They are not 100 percent efficient in that regard, though; are they?

Dr. DAUGHERTY. Not 100 percent efficient. I don't know just exactly what the percentage is, but they have accomplished a great deal in recent years in recovering sulfur that formerly went into the air.

Mr. PRICHARD. But there is an element of pollution from that part of the petroleum industry as well?

Dr. DAUGHERTY. Yes, there is a small amount; yes.

Mr. PRICHARD. You might say that the consumption of gasoline and the manufacture of gasoline are all a petroleum product?

Dr. DAUGHERTY. Yes. The refineries do contribute, we will say, something on the order of—well, in the present refining process, I believe they estimate 130 tons of hydrocarbons per day as contrasted with the automobiles of 1,100 tons per day and then in addition to that, there is about another 130 tons or more that is liberated during the marketing and distribution of gasoline.

For example, when a person drives an automobile into a filling station and has the tank filled with gasoline, a tank full of gasoline vapor must be discharged into the air. Every time a big tank truck rolls into a filling station to fill an underground storage tank, gasoline vapor is put out into the air.

In the very near future, those emissions from the marketing operations are going to be controlled. It will take some time yet before there will be a device so there won't be any emissions from the automobiles as they are being filled.

On top of that, something else that the public does not realize is that if all the automobiles in Los Angeles County were standing in a garage and not one operating, the evaporation from the gasoline, from the carburetors, also would be in the order of 100 tons per 24 hours. I don't remember the exact figures but it is negligible even there.

Mr. PRICHARD. Well, the net result of all this adds up to the fact that our efforts at the elimination of smog have not even touched 40 to 50 to 60 percent of the problem and with reference to the remaining percentage of the total problem, we have only reduced the amount of smog, we have not completely eliminated it.

Dr. DAUGHERTY. No; we have reduced a great deal. If nothing had been done in the past 5 or 6 years, the conditions would be far worse.

Mr. ROOSEVELT. We might have had a catastrophe.

Dr. DAUGHERTY. I think the air pollution control officer has achieved something. He has been able to hold his own in the face of what he has had to contend with.

Mr. BISCAILUZ. I have just one question, Professor. Can we expect in the future other sources of air pollution which don't exist at the present time that would aggravate the present situation?

Dr. DAUGHERTY. Other sources? No; I don't think of new sources that are apt to develop unless it can be from atomic energy.

Mr. BISCAILUZ. Atomic energy would be an example?

Dr. DAUGHERTY. We don't know what is in store for us there.

Mr. BISCAILUZ. So we have to more than keep up with the present problem?

Dr. DAUGHERTY. That is right.

Mr. BISCAILUZ. We have to keep up with the present problem in order to prepare for what may come in the future?

Dr. DAUGHERTY. That is right.

Mr. PRICHARD. Would there be some new chemical process which might cast off into the air different forms of pollutants than we have now?

Dr. DAUGHERTY. Well, I very much doubt that. I do think atomic energy and related activities may contribute something, but I don't believe there is any other new development in the chemical industries. The present chemical industries, the paint companies, and the automobile painting companies are working very hard now to find solutions to their problems. Even the people who smoke hams and bacons are spending lots of money to control the smoke in the smokehouses. Nobody has thought of doing that any place, not even in Chicago.

Mr. ROOSEVELT. We want to thank you very much for your very helpful testimony, Dr. Daugherty.

The committee is in recess now at this time because our good reporter has been under quite a strain for some time.

I want to briefly summarize the hearing today. We have heard this morning from witnesses who established the serious business loss to the community of the smog. We heard from Mr. Will as to what was being done, in his opinion, from a point of view of the board of supervisors from the point of view of control and enforcement.

This afternoon, we have had the benefit of witnesses who have described to us the problem from a technical point of view. Tomorrow morning we will hear from the witnesses who will describe to us the health menace and relate to us the urgency of the solutions which are required, following which, as the last witness, we will hear from the control officer of the Air Pollution District, Dr. Griswold, and members of his staff will be present.

Now, I know that there may be other people present who would like to submit testimony. We would be very glad to receive it for the

record if you will come and deliver it either to Mr. Biscailuz or to Mr. Prichard, and I am sure you can understand that while we would like to hear all of you, physically, it is impossible for us to do so. However, I believe there are 1 or 2 others who are present with whom we did make arrangements to hear. I believe one of them is Mr. Karbiner. Is Mr. Karbiner here?

(No response.)

If he is not here, that will eliminate that.

Mr. PRICHARD. Is Mr. Phillips here?

Mr. SHEEHAN. No; he will be here tomorrow.

Mr. PRICHARD. Is Mr. Aldrich still here?

(No response.)

Mr. ROOSEVELT. Mr. Aldrich is not here.

Mr. O'Day, I would like to hear you today. I know you have a long story. I am trying to make it possible, if you would, to submit it in writing.

Mr. PRICHARD. Is Mrs. Grayson here?

(No response.)

I wanted Mr. Packard to take the stand. Mr. Packard, would you come back tomorrow morning?

Mr. ROOSEVELT. Mr. O'Day, I am not quite sure how we can fit you in. We did promise certain witnesses that they could be here and be heard in relation to this Federal contribution, and yours primarily is on the local level, as I think I discussed with you, but we will be very glad to try to work it in.

Mr. Packard, can you be available tomorrow morning?

Mr. PACKARD. In the morning I could.

Mr. ROOSEVELT. Suppose we start a little bit earlier tomorrow morning. The committee will be called to order at 9:30 and we will take you first, Mr. Packard, if that is agreeable to you. At 10 o'clock we will take the other witnesses. Mr. O'Day, if we can possibly work you in, we will work you in for 10 minutes, but you must confine yourself to the 10-minute period.

Mr. PRICHARD. May the record show that we have received a written statement from Dr. Daugherty.

(For statement referred to, see p. 209.)

Mr. ROOSEVELT. We are very grateful to all of you, and we are recessed until 9:30 tomorrow morning.

(Whereupon, at the hour of 4:30 p. m., the committee was adjourned.)

AIR POLLUTION PROBLEMS

SATURDAY, MAY 19, 1956

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE NO. 5 OF THE SELECT COMMITTEE
TO CONDUCT A STUDY AND INVESTIGATION OF SMALL BUSINESS,
Los Angeles, Calif.

The subcommittee met, pursuant to recess, at 9:30 a. m., in courtroom No. 9, United States Post Office and Courthouse Building, Los Angeles, Calif., Hon. James Roosevelt (chairman of the subcommittee) presiding.

Present: Representatives Roosevelt, Sheehan, and Steed.

Also present: Warren H. Biscailuz, subcommittee counsel; Katherine C. Blackburn, staff member; and S. V. O. Prichard, subcommittee special consultant counsel.

Mr. ROOSEVELT. The committee will come to order, please.

The committee is very happy this morning that Congressman Steed, a member of this subcommittee, is with us.

Our first witness this morning will be Francis H. Packard, who has done considerable work on the problem of smog, and I want to emphasize for the information of the press that this is with the understanding, of course, that Mr. Packard is a candidate for public office, but there is an agreement between the committee and Mr. Packard that he will talk only on the scientific aspects of smog, and all political considerations will be out of order.

Mr. Packard, will you raise your right hand and be sworn? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. PACKARD. I do.

TESTIMONY OF FRANCIS H. PACKARD, PASADENA, CALIF., CHAIRMAN OF CITIZENS ANTI-SMOG ACTION COMMITTEE

Mr. PACKARD. My name is Francis H. Packard, 1251 Bresee Avenue, Pasadena. I am the chairman of the Citizens Anti-Smog Action Committee, a nonprofit organization of citizens banded together, dedicated to the use of every weapon within the law to restore fresh air to southern California before we have an air-pollution disaster.

I have tried to document the various statements which I will make.

Mr. ROOSEVELT. Do you want to submit the documentation as evidence for the committee?

Mr. PACKARD. Yes, sir.

Mr. ROOSEVELT. You might hand them to the reporter and he will mark them as we go along, and without objection we will receive them in evidence.

Mr. PACKARD. We welcome your committee to Los Angeles. It is nice to know that one agency of our Government is interested in protecting the public from this manmade menace that threatens our lives, damages our health and our business.

As chairman of the Citizens Anti-Smog Action Committee I have talked with scores of small-business firms and know that they are all adversely affected by smog to some degree. The most directly affected are those engaged in raising plant life, whether it is vegetable, flower, or fruit. Their damage is almost immediate, and unlike damage to health, has been conclusively proven. Many of these people have been driven out of this area.

Business catering to the tourists also suffer in that tourists will not linger during periods of severe smog. Retail stores also suffer in that the public will not go shopping during heavy smog.

Let me call your attention to the damage that smog is doing inside our retail stores. The manufacturers of Playtex children's clothes have had so many complaints that they were forced to pick up all of their products from local merchants' shelves and replace them in airtight packages. One of their representatives told me Los Angeles is the only place in the world where they have suffered such losses and where they have to package their product in airtight containers.

(The correspondence referred to is as follows:)

CITIZENS ANTI-SMOG ACTION COMMITTEE, INC.,
Pasadena, Calif.

INTERNATIONAL LATEX CO.,
Playtex Park, Dover, Del.

GENTLEMEN: It has recently come to our attention that your company has suffered severe losses in damage caused to your rubber products due to our air-pollution problem, misnamed "smog."

From what we hear, many merchants have had to replace rubber products due to deterioration on their shelves which we hear your extensive research has developed as being caused by smog.

We further hear that the Los Angeles Basin is the only area in the world where this type of damage has occurred to merchandise on the merchants' shelves.

If rubber goods disintegrate, as one lady told me a pair of your baby pants did the first time she tried to use them, what is it doing to our lungs?

If these facts are true and if you have conducted extensive research and determined that smog, or some element of smog, has caused this damage, we would most certainly appreciate it if you could give our voluntary citizens committee a report on your findings, etc.

Any information you can give us that may help us in our fight to regain healthy air before we have a disaster will be greatly appreciated.

Yours truly,

FRANCIS H. PACKARD, *Chairman.*

NOTE.—I hear they are going to all stores and picking up all damaged products and returning them to factory. All merchandise being replaced in airtight packages. One small drugstore turned back $83.

Using this small store as a guide, it wouldn't be out of line to figure the total cost is going to run from $300,000 to $500,000.

INTERNATIONAL LATEX CO.,
Playtex Park, Dover, Del., February 7, 1956.

CITIZENS ANTI-SMOG ACTION COMMITTEE, INC.,
Pasadena, Calif.

(Attention: Mr. Francis H. Packard, chairman.)

GENTLEMEN: We received your letter dated January 21, 1956, in which you asked for a report on our research findings on smog.

We do recognize that smog is often accompanied by a higher than normal concentration of ozone. It has certainly been well established by the rubber industry that ozone has a deteriorating effect upon rubber.

We regret that we have not conducted any research which would yield authoritative information about the extent of the damage to rubber products caused by the ozone concentration of the atmosphere in southern California.

If, in the future, we do obtain results which would be helpful to you, we will be glad to furnish them to you.

Yours very truly,

WILLIAM J. CLAYTON,
Products Manager, Products Division.

Mr. PACKARD. A thorough investigation will show that small business has been discriminated against by our public servants. Major smog sources, such as Edison's various powerplants and the city of Los Angeles valley steam plant, are allowed to operate without any control whatever, even though we have had an Air Pollution Control District for 8 years. This is even more astounding when you realize one such stack is capable of polluting the air with more smog-forming sulfur than every auto, bus, and truck in the county.

Our public servants are drastic on minor sources of air pollution such as steak houses, residential contractors, trucking concerns, and so forth.

Mr. ROOSEVELT. May I ask you in relation to the powerplants you referred to, do you mean privately owned or publicly owned or both?

Mr. PACKARD. Both.

I believe that if you were to secure a record of all the citations issued last year you will find that small industry has again been penalized and has carried the burden of the citations issued.

For years we have been told that smog was a product of our automobiles, and incinerators, and that industry was clean. I have here a few color slides I have taken of various smog-producing industries that I will turn over to your committee. I am sorry I didn't have time to get colored photographs.

(The slides referred to were placed in the files for use of the committee.)

Mr. PACKARD. Our study of our air-pollution problem indicates that smog is the biggest hoax that has been put over on the public since the days of the Trojan horse. It is a product of the petrochemical industry. Whatever the automobiles' contribution to smog is, it also is a product of the petroleum industry. This hoax has been made possible with the aid of propaganda agents and our county officials in adopting weak rules and regulations.

Smog was unknown in this area until July 26, 1943. Newspaper files show that on July 26, 27, and 28, 1943, Los Angeles was blanketed with a mystery cloud. I'm told these dates coincide with the date the first catalytic cracking refinery went into operation. Many additional cat-crackers have since been built so that today we have one of the largest concentrations of refineries in the world in an area where none should be allowed.

I feel the refineries can eliminate their air pollution and I am attaching hereto copies of correspondence with the inventor of the catalytic-cracking refinery, and also copy of a report made to the Los Angeles City Council by Councilman Debs, who visited refineries that are equipped to eliminate their air pollution. These documents claim to show they can eliminate their air pollution.

(The documents referred to follow:)

REPORT OF COUNCILMAN ERNEST E. DEBS, ON VISIT TO SUN OIL REFINERY AT MARCUS HOOK, PA.

(Report on smog as follows, beginning with page 4 of Mr. Debs report:)

Upon instructions of the city council, I accepted the invitation of Dr. Houdry to visit the giant refinery of the Sun Oil Co. in Marcus Hook, Pa., near Philadelphia.

I saw an installation of catalysts on a petroleum-cracking plant burning up carbon monoxide and hydrocarbons similar to those which pollute the air in Los Angeles and which, according to Dr. Paul Kotin, of the University of Southern California, have caused cancer in mice. I also saw a catalytic muffler for automobiles under final performance tests.

The muffler is expected to remove up to 90 percent of the dangerous carbon monoxide and hydrocarbons from automobile exhausts. The catalysts, one for the refineries and a revolutionary new one for exhausts, are the development of Dr. Eugene Houdry, the famous scientist and president of Oxy Catalyst, Inc., in nearby Wayne.

Dr. Houdry told me that the catalytic muffler would be placed on the market before the end of the year. He also told me much more than that. *He stated, unequivocally, that the main offenders in the Los Angeles area were the oil refineries.* He listed as also a heavy contributor the distribution of petroleum products, both to the service stations and from the service stations to the users. He also included as heavy contributors, buses, trucks, and private automobiles. He doubted that the private incinerator contributed much more than 10 percent.

My tour of the Sun Oil Co. refinery occurred on a day similar to what Los Angeles has been experiencing in the last 2 months. There was a low fog hanging over the city and very little wind, but, in approaching this refinery, one could detect little of the odors such as we have in the vicinity of our local refineries.

In talking with the engineers of the Sun Oil Co., I learned that the catalyst installment in unit 3 of plant 12 creates 500 pounds of steam and at the same time generates 200 kilowatts of electricity per hour—all from waste carbon monoxide and hydrocarbons such as pollute the Los Angeles air. *The bed of oxidizing catalysts, I was told by the oil company engineers, has already paid for itself in heat recovery after only 16 months of operation* on a 24-hour-day basis and that the catalysts are still as completely efficient, removing 99.2 percent of combustibles, as they were when installed in June 1952. [Italic added.]

In other words, there is a great incentive to our own refinery owners in Los Angeles because there is a reward here in heat recovery for abating the pollution of our air.

A comparison between the Sun Oil Co. refinery at Marcus Hook and the new Sun Oil Co. plant which I visited at Toledo, Ohio, which is the last word in the development of the catalyst for cracking of gasoline, is obvious. At Toledo, Ohio, it was easy to see the terrific pollution of the air from the operation there where the oxycatalyst had not been installed.

I understand from Dr. Houdry that a new installation of the Oxycatalyst will be installed in the near future on a plant at El Paso, Tex. I would recommend to the council that a committee be sent to view, firsthand, that which I have already seen.

It should not be necessary to remind the council that I am only a layman, but that I talked with scores of men in the East who smiled knowingly when the subject of smog was discussed. Some who talked requested that they not be quoted because they are employed by large industrial firms who are contributors to the smog in their own areas. (Los Angeles is not alone in the problem of air pollution. Every large metropolitan industrial city I visited had smog in more or less degree than Los Angeles.) Those that would be quoted stated emphatically that the large growth in the industry during the last World War has brought as a No. 1 problem to be corrected in Los Angeles, the abolishment of the pollution of air. They are also of the opinion that it is a matter of cold dollars and cents to be expended by the industries responsible for air pollution.

However, it is the general consensus that most of the industry will not expend the kind of money needed to stop the pollution of our air unless it is made mandatory by those in charge of our air pollution.

It is my considered opinion that the air pollution control board knows who is polluting our air and to what degree they are in violation. They have had 4 years to make a comprehensive study of the problem. The means are avail-

able. We have no excuse not to clean up our air. We have been told by Mr. Larson that no new laws are needed, that he has the power to compel people, both in industry and the general public, to stop the pollution of our air.

Los Angeles is the smog laboratory of the world. We have an opportunity now to attack the problem and in solving it set the pattern for other cities plagued by smog throughout the world.

According to the United States Public Health Service in a release October 14, 1949, and I quote: "In addition to the 20 deaths in Donora, Pa., the illness of 5,910 persons, 43 percent of the population, was caused by smog which hung over Donora and the nearby community of Webster for 5 days beginning October 27, 1948."

In February 14, 1953, issue of the British medical journal, Lancet, Dr. W. P. D. Logan, chief medical statistician of the General Register Office, London, England, reported in December 1952, a 4-day fog in London caused about 4,000 deaths. It is to be hoped that such an event will never reoccur or be allowed to reoccur.

But all these episodes took place outside of Los Angeles. It can't happen here, or can it?

Dr. Clarence A. Mills, nationally known professor of experimental medicine from the University of Cincinnati Medical School, in testifying before an assembly committee on air and water pollution stated, "On September 23, 1949, known as Black Friday *in Los Angeles because of the dense smog, 53 persons died of respiratory or cardiac diseases in the county. On a normal day, only 37 persons would die of such ailments.*" [Italics added.]

Two thousand five hundred and sixty-one Los Angeles doctors out of two thousand eight hundred and three reported to the medical association last year that the Los Angeles smog is harmful to the human body. In other words, more than 91 percent of the interested doctors expressed their belief that smog was damaging the lungs, hearts, eyes, throats, noses, and other organs of the people of Los Angeles.

Smog is damaging our crops. It is also damaging the reputation of our city, because everywhere I went in the East, the first question that was asked me was what are we doing about our smog problem.

The board of supervisors must be made to realize that public health is more important than political expediency. The air pollution control board must set a time limit which all manufacturers must meet to stop, to cease and desist the pollution of our air. The causes of pollution are known. In my opinion, the cures are available. We must quit talking about it and demand that action be taken.

CITIZENS' ANTISMOG ACTION COMMITTEE, INC.,
Pasadena, Calif., February 15, 1955.

Mr. EUGENE J. HOUDRY,
Oxy-Catalyst, Inc., Wayne, Pa.

DEAR MR. HOUDRY: For years the citizens of this area have been suffering with a blight misnamed "smog" which many people attribute to an invention of yours.

In our antismog crusade we get information from many sources, some of it rumor, and some of it fact. For this reason I am writing asking for information in an attempt to verify or disprove some statements made to us.

I have been told that when you invented the catalytic gasoline-cracking process you realized what your invention would do to the air and that you continued your research resulting in another invention that, if used, eliminated air pollution. Further, I am told that the oil industry bought the first patent but did not buy the preventive equipment.

If agreeable, I would like to know:

1. Is it true you have an invention that will eliminate the emission of effluents or pollutants into the air from catalytic cracking operations
2. Would this invention be the same as mentioned in Time for June 9, 1952, telling of your success with Enamelstrip?
3. If true, how long has the equipment been available?
4. What is the name it is sold or leased under?
5. What is the approximate cost of such equipment?
6. Is it being used satisfactorily on any gasoline-cracking plants today? If so, please give name, location, etc.

I assure you we will appreciate receiving your answers to my questions, plus any additional information I have overlooked that would be pertinent.

Thanking you in advance, I am,

Sincerely,

FRANCIS H. PACKARD,
E. JAMES LEE,
Cochairmen.

OXY-CATALYST, INC.,
Wayne, Pa., February 28, 1955.

Mr. FRANCIS H. PACKARD,
Cochairman, Citizens Antismog Action Committee,
Pasadena, Calif.

DEAR MR. PACKARD: Thank you for your letter of February 15.

First, I would like to clarify the association between my inventions for catalytic cracking and for air pollution control. When catalytic cracking was developed I did realize that the fumes contained a certain amount of carbon monoxide and unburned hydrocarbons which would generate substantial heat energy if oxidized. To recuperate this waste heat, I have developed a process which is attractive from an economic standpoint.

With reference to your questions concerning this new invention, I am listing the following answers in the same order:

1. It is true that we have an invention that will oxidize the hydrocarbon vapors and carbon monoxide from the catalytic cracking regeneration fumes.

2. This invention embodies the same catalytic principles that were mentioned in Time magazine in 1952, when we installed this process for the first time at Enamelstrip Corp., in Allentown, Pa.

3. Although the equipment was first installed on a Houdry fixed bed unit in 1952, the adaptation of the process to the catalytic cracking units of the type in service on the west coast has only been perfected very recently. Actually, we presented this process to refiners on the west coast in December 1954.

4. This process is called the Oxycat. It is being sold by Oxy-Catalyst, Inc.

5. The cost of the equipment varies greatly with the type and size of the unit. Usually these are sizable installations and it is not uncommon for a complete installation to cost well over $200,000. Such installations can pay for themselves through heat recovery.

6. At present the process is used in the refineries of the Sun Oil Co. and the Standard Oil Company of Texas at El Paso.

Please be assured that we are doing everything possible to incorporate installation of the process in refineries in your territory. (This information may be released to members of your committee but not to the press.)

Very truly yours,

OXY-CATALYST, INC.,
EUGENE J. HOUDRY, *President.*

Mr. PACKARD. I'd like to point out another occurrence that indicates the part refineries play in our smog problem. It also indicates to me that our county supervisors are shielding and protecting the oil industry to the detriment of all other industry and the health and welfare of the public.

Just a year ago we had a major smog attack. It coincided exactly with the breakdown of a scavenger plant. The day before the breakdown, and the day after repairs were completed, we had no smog. In spite of the fact that the APCD had a record of this breakdown in their files that showed the amount and kind of pollution going into the air no mention of it was made. Instead news media carried reports "don't drive your car and don't burn your incinerators."

After being given the information that Hancock Chemical Co.'s scavenger plant was out of service we attempted to inspect the records of the APCD to see if similar breakdowns coincided so closely to other serious smog attacks. The records were brought out for our inspection but before we could copy the information we wanted the records were taken from us.

We saw their records long enough to know that the APCD is informed when these plants are out of service. These records indicate the type and kind of contaminants, number of tons, and so forth.

We later asked the board of supervisors to instruct the APCD to allow us to inspect these records but instead were told that if we wanted to see these records it would be necessary for us to go to court and seek a writ of mandamus to compel them to open their records to us. For financial reasons we have been unable to take this action.

After seeing these records and what they contain, and finding out how adamant the supervisors are in keeping these records secret, there is only one conclusion that can be drawn and that is that releasing this information to the public would conclusively prove that they have been shielding and protecting the oil industry. Full details are attached.

Mr. ROOSEVELT. You are submitting the supporting documents as part of the record?

Mr. PACKARD. Yes.

I believe that one of the best things your honorable committee could do to help small business and the public would be to subpena these records in order that they can be examined and compared with air pollution charts. I would like to request that you ask to be allowed to inspect these records. If they refuse I would like to suggest that you subpena them. I feel that if these records were exposed to public view it would dispel the mystery about smog unless their records have been doctored in the past year.

Later we learned that this scavenger plant was broken down and out of service on an average of 1 day out of 4. The first 7 months of 1955 they were closed 50 days for repairs. As a result of this our committee recommended to the supervisors that all refineries be compelled to construct duplicate, or standby, plants. The need for standby equipment was denied by the APCD on August 26, 1955, but it is interesting to note that on May 11, 1956, the APCD put out a news release stating that Hancock was granted a permit to construct a new plant and that, and I quote:

> Control officials emphasized that the new recovery plants will serve present requirements for standby capacity to be used when existing recovery equipment is removed from operation either for mechanical failure or maintenance.

If automobiles are the major uncontrolled source of smog, why did we have smog during the war years? Our population of automobiles and incinerators was considerably less than today, yet we had smog. Gasoline was rationed and car pools were in operation, which further reduced automobile traffic, yet we had smog.

If automobiles are the major source of smog why didn't Pasadena have smog January 2? It was estimated that Pasadena was host to the largest crowd in its history to see the Rose Parade, the Rose Bowl Game, the Post Parade area, plus the racetrack traffic. In spite of this large influx of automobiles and resulting traffic congestion, bumper-to-bumper stop-and-go driving, it was a beautiful day. The sun was shining to react upon the exhaust gases, yet no smog. We had a low enough inversion to have caused smog if the automobiles are such a prime source of air pollution, yet no smog. I am attaching hereto reports on weather conditions January 2 from the United States Weather Bureau and from our county air pollution control district. It is interesting to note the wide variation in figures between these

two agencies who both use the same Long Beach inversion sounding figures.

In view of all of these facts I find it hard to believe that the automobile is the major source of our air pollution.

I realize it is a contributor.

We have had an air pollution control district for 8 years. We have a good State law, particularly section 24243 of the Health and Safety Code, but our county officials have minimized it by enacting weak operating rules and regulations that in effect allow them to swallow a camel while straining at a gnat.

Each year our supervisors spend more of our taxes and issue more citations but each year smog grows more deadly and covers a wider area. Last year they claim to have issued more citations than in all the previous years of APCD combined. Last year they spent more money than in any previous year. What did it accomplish? Last year was the worst smog year on record. This past December and January was the first time that farmers and florists suffered crop damage during these winter months. Many days last year broke all previous density records and our public servants are predicting this year will be the worst year yet.

I believe a continuation of the supervisors' past policy of procrastination and not being as drastic on major smog sources as they are on minor sources can only result in a mass air pollution disaster. When such a disaster occurs every health agency of the Federal, State, county, and city governments will be conducting an investigation but it will be worthless in restoring life to innocent victims. I am firmly convinced that smog can be eliminated and that our supervisors are derelict in their duties in protecting our health and welfare. Unless drastic constructive action is taken we are due for such a disaster and when it happens I feel that our public servants responsible should be charged with mass murder.

It is my hope that your investigation will develop the need for a full, impartial investigation by your full committee to help prevent such a disaster.

The 1954 grand jury charged the supervisors were careless and at times negligent in not providing the means to shut down all industry if a disaster seemed imminent. As a result of this the supervisors did adopt what is known as regulation VII which was supposed to enable them to prevent such a disaster. Our committee charged that this regulation VII is a fraud on the public and asked the 1955 grand jury to conduct an investigation into regulation VII without success.

In conclusion I would like to say that I do not believe there is any mystery as to what smog is. The mystery is why have our public servants permitted this menace to exist.

I am convinced that smog can be eliminated quickly once our public servants acquire the backbone or intestinal fortitude to enact strict rules and regulations that will in effect tell all sources of air pollution, "Clean up or be closed." Once such an attitude is adopted I am confident air-polluting industry will quickly find the equipment necessary to eliminate their air pollution.

I feel our public servants need to take a lesson from our forestry department. Unfortunately, we have many forest fires in California. A friend of mine who was a forest-fire fighter told me they were never

sent out to capture some smoke and bring it in to be researched to see what was burning. Instead they were told to go put it out and they used every means, except propaganda and excuses for their failure, to do so.

Our committee has compiled quite a file on air pollution and we will be glad to assist or to make copies of our files available to your committee. Thank you.

Mr. ROOSEVELT. Thank you, Mr. Packard. Let me say that we, of course, are interested in your statements regarding what you think are the failures of local enforcement agencies. I must emphasize that, unfortunately or fortunately, whichever may be the case, it is outside of the jurisdiction of this committee, except as we are a means of bringing it to the attention of local authority that more can be done than has been done by local authority.

As far as looking into further records, the committe will take that under advisement and if we feel that comes within our jurisdiction, why, of course, we would ask to see them, but we must, I think, be satisfied that it will contribute to the specific purpose of our committee, which is the protection of small business, interstate commerce, and the public health of those involved.

I have just a few questions: One, in relation to the scavenger plant that you have discussed. It is my understanding from what you said that this one scavenger plant services all of the refineries of the area?

Mr. PACKARD. Not all ;it services three of the major ones, the General Petroleum, Richfield, and Texaco.

Mr. ROOSEVELT. What is the purpose of this scavenger plant?

Mr. PACKARD. A scavenger plant takes the refuse which otherwise would be dumped into the air. They reprocess it and recapture sulfur primarily, maybe other things, and it keeps that pollution from going into the air.

Mr. ROOSEVELT. This is a byproduct of what is recovered by the machinery that is in each of the refineries themselves and brought over to this plant?

Mr. PACKARD. No. It is piped over to the Hancock chemical plant.

Mr. ROOSEVELT. It is piped over there?

Mr. PACKARD. Yes.

Mr. ROOSEVELT. Does this plant operate for profit?

Mr. PACKARD. I assume so. I understand it does.

Mr. ROOSEVELT. In other words, the byproducts collected are then salable?

Mr. PACKARD. Yes.

Mr. ROOSEVELT. How long has this plant been in operation?

Mr. PACKARD. I don't know when it was first built. I have never seen any records or information on that, sir.

Mr. ROOSEVELT. Have you any records—has your committee any records which would indicate as to the efficiency of the operation of the plant when it is in operation and not shut down?

Mr. PACKARD. As to the efficiency while it is in operation, no. We have a letter that was addressed to Supervisor Hahn by the district which gave the figures that they were out of service due to breakdown 50 days in the first 7 months of last year.

Mr. ROOSEVELT. What I was more interested in was the technical knowledge as to how much of the pollutants that normally would go into the air it does recapture while it is in operation.

Mr. PACKARD. How much they recapture in their operation?

Mr. ROOSEVELT. Right.

Mr. PACKARD. The district should have that, but I do not have it.

Mr. ROOSEVELT. All right.

Mr. PACKARD. I do know when they broke down and were out of service we had a terrific smog attack.

Mr. ROOSEVELT. Do those documents that you have submitted show that when it is out of service there is greater smog?

Mr. PACKARD. Just on the one instance, because we tried to find out the actual date those 50 days were. Those 50 days out of 7 months doesn't mean anything, but if you had them pinned down to the actual days they were out of service so you could chart on an air-pollution chart that was developed by Dr. Haagen-Smit, then you could see if there was a correlation or if this was just merely a coincidence. That is what we were trying to develop at the time we saw these files.

Mr. ROOSEVELT. Now the records which you asked for and which you say were not made available to you, are these the records of a public agency?

Mr. PACKARD. Yes; they are compiled at taxpayers' expense. We saw them long enough to know that when a scavenger plant is broken down and out of service that it is immediately reported to the district. Now, they also have a different set of files there in that they wrote these various plants and asked for that information which was given to them, but in each letter that came back there was a notation asking that this be withheld from the public.

Mr. ROOSEVELT. Who was that letter to?

Mr. PACKARD. To the Hancock Chemical and various other plants that have similar scavenger plants.

Mr. ROOSEVELT. Was there any reason given for withholding them from the public?

Mr. PACKARD. They were afraid that if it were shown to me that I might take a secret of one company and peddle it to another. I think that was what I was told.

Mr. ROOSEVELT. Now, Mr. Packard, you mentioned that during the war years when there was very much reduced automobile travel that there was still smog available?

Mr. PACKARD. Yes.

Mr. ROOSEVELT. I believe our technical testimony yesterday indicated that smog would be in existence under various conditions and that in previous years the amount of pollutants that were going into the air from the refineries and industrial areas was at that time so much greater that that would create smog in itself and that now that that had come under some control, but, however, there had been no reduction in smog because while that went down the automobile contribution to smog had increased so that the net result was no better; in fact, it was worse because of the tremendous increase.

Would you comment on that from your viewpoint?

Mr. PACKARD. Our study of the air pollution problem in the past year and a half indicates that the automobile is a contributor, but our public officials have magnified its contribution time and time again. As I mentioned, New Year's Day——

Mr. ROOSEVELT. The scientists who were here yesterday were not public officials.

Mr. PACKARD. Some of the scientists, too, then, include them as well as these public officials.

Mr. ROOSEVELT. However, would you not think that—in other words, what you are trying to say to the committee is that the industrial control is nowhere near as effective as they claim it is.

Mr. PACKARD. Absolutely.

Mr. ROOSEVELT. And that if it was exercised in a more uniform manner, to put it politely, that it would be a real contribution in the cutting down of existing smog?

Mr. PACKARD. That is right. I didn't mention it a minute ago, but January 2 when I mentioned the concentration of automobiles, we had no smog. Everything was present that would contribute to a smog attack. The next day I took some friends from back East and we took a little trip to Mexico and on the way down to the Wilmington area we approached the smog, and the farther down we got the more we ran into it. When I came back I found that almost on schedule it was in Pasadena around noon, which was another indication of the concentrated refinery scavenger plants, chemical plants section down there.

Mr. ROOSEVELT. Testimony yesterday was that those plants will never shut down.

Mr. PACKARD. They operate 24 hours a day 7 days a week, but they also can operate on a very minimum scale over a holiday period, just barely keep the fires going, shall we say.

Mr. ROOSEVELT. So in those days, even though technically they are in operation, you feel their emission is so much less that it would be a significant fact that there was no smog because of their lack of full operation?

Mr. PACKARD. You can pass by those places on a holiday and look at your parking lots and you can see the difference in the number of employees.

Mr. ROOSEVELT. Mr. Steed?

Mr. STEED. No questions.

Mr. ROOSEVELT. Mr. Sheehan?

Mr. SHEEHAN. Mr. Packard, you represent a citizens association, and as such did you ever try to take any scientific—or have any scientific studies been made of the causes that you are attributing?

Mr. PACKARD. The citizens' committee is handicapped, and I think it is true of any citizens' organizations, handicapped for the lack of funds. We have never had adequate funds to have any research done on our own. We have had to rely on the results of other people's research.

Mr. SHEEHAN. Well, of course, that is what, as a committee, we are interested in. We, sitting here, are listening to testimony, and naturally we are going to give more weight to expert testimony than we are to people who are making observations, and in order for your position to be considered adequately, it should be supported by some scientific or other expert knowledge so that we ourselves can judge it properly. For instance, you say there is no mystery what smog is. Well, looking at it from the last day of testimony, there is still a mystery as to what it is.

Mr. PACKARD. That is true, but I brought those few color slides there of various industrial sources which I thought you might like to look at sometime. It is plain to be seen if you drive around these

sources, fly over them, and so forth, that your eyes or your nose will tell you, whether you are educated technically or not.

Mr. SHEEHAN. However, we did have testimony yesterday by several of these mechanical engineers who have testified that most of the larger industrial units are attempting to limit the emission into the air of the harmful things that they can find.

Mr. PACKARD. One of the members of our technical advisory committee is in the audience, Mr. Willard. If you would like to talk to him, I am sure he would be glad to speak. He didn't come prepared or expecting to speak, but I am sure he would be glad to speak, and he is a technical man.

Mr. SHEEHAN. I would suggest that you have him reduce it to writing and turn it in to the committee, with the permission of the chairman, and then we will have something tangible to support your position.

I did notice that you mentioned that the committee officials or the county officials should take very stringent action and actually shut down people that are violating the law; is that right?

Mr. PACKARD. Yes. I don't think that would ever become necessary to actually shut them down, but to let them know that they will do it if necessary to protect the health of the public, and I think that then they would start to comply.

Mr. SHEEHAN. Of course, that is one of the things that we as a committee are interested in or which it concerns itself with, for the simple reason, we will grant that maybe Richfield Oil or someone like that can spend the necessary money and take the precautionary methods, but the average small-business man who doesn't have too much capital invested, and especially where there is no scientific knowledge of how to do the job, he might be polluting the air, but do you just want to shut him down and throw him out of business?

Mr. PACKARD. No. I think that normally the smaller businesses are already being compelled to comply, and I think that the records will indicate that already some small businesses have been compelled to go out of business because they couldn't afford the necessary control equipment.

Mr. ROOSEVELT. We had testimony to that effect yesterday.

Mr. SHEEHAN. I am only trying to put into relationship your statement of taking definite and drastic action, and I sometimes question that even public officials can do that, because you can't arbitrarily throw a lot of people out of business and cause them to lose their business when you don't know what the causes and what the remedies are.

Mr. PACKARD. That is true. That is, they have the right to the protection of the law, the same as the public has. There are 5 million citizens here, and there is a small segment of our industry that is a major source of our smog.

Mr. SHEEHAN. What would you say that part of the industry is?

Mr. PACKARD. The petroleum industry and the allied chemical plants, and you would include also those plants like the powerplants that use their cheap fuel oil.

Mr. SHEEHAN. On the other hand, and this is no excuse for it, were it not for those industrial plants, the population of Los Angeles would be way down.

Mr. PACKARD. The refineries themselves have a relatively small number of employees.

Mr. SHEEHAN. And I was going to say what was said the other day: On Saturday and Sunday, you may not see a lot of automobiles around, but the total plant personnel compared to office personnel and so on is very small, and they can keep the plant running, the actual productive operation going with a relatively small number of employees, and it might be that while there are not a large number of employees in the plant, the plant may be going pretty much full blast.

Mr. PACKARD. They also have a way of continuing operation on a minimum schedule.

Mr. SHEEHAN. That is right. That is all, Mr. Chairman.

Mr. ROOSEVELT. Mr. Prichard?

Mr. PRICHARD. I should like to ask 1 or 2 questions if I may. Do I understand correctly, Mr. Packard, that so far as smog control by the petroleum plants, that is accomplished through what you describe as a scavenger plant?

Mr. PACKARD. That is partially so. There are other controls necessary too, but that is the major thing. That is the product of the cat-cracker itself that goes into that.

Mr. PRICHARD. The major control then, so far as catalytic plants are concerned, is the scavenger plant; is that right?

Mr. PACKARD. That is my understanding.

Mr. PRICHARD. And one scavenger plant is erected to take care of several refineries.

Mr. PACKARD. In some instances. Hancock does serve several of them. Several of the plants have their own. Standard Oil uses Standard Chemical. Shell Oil uses Shell Chemical. Wilshire Oil has their own scavenger plant, and I believe Union Oil has their own scavenger plant.

Mr. PRICHARD. Now, you made your check with reference to this one scavenger plant at Hancock; is that right?

Mr. PACKARD. Yes.

Mr. PRICHARD. And your information was that that plant was out of operation 1 day out of 4 during the critical period that you examined; is that right?

Mr. PACKARD. Yes, sir.

Mr. PRICHARD. Would it be a correct statement to say, assuming that fact to be correct, that it was out of operation 1 day out of 4, that during 75 percent of the time there was no control over the casting of pollutants into the air?

Mr. PACKARD. During 75 percent?

Mr. PRICHARD. Well, 1 day out of 4 is 25 percent.

Mr. PACKARD. 25 percent.

Mr. PRICHARD. During the remaining 75 percent, what control would there have been over the casting of pollutants into the air from those plants?

Mr. PACKARD. Well, the scavenger plant would naturally take care of the pollution they received. As I understand, though, the scavenger plant does put out some pollution when it is in operation. There is a rule in the rules and regulations that allows them a certain amount.

Mr. PRICHARD. Well, if the scavenger plant is broken down, is there any control over the casting of pollutants into the air by the refineries that that scavenger plant serves?

Mr. PACKARD. I see what you mean. During the period that a scavenger plant is broken down, what do the refineries do; is that what you mean?

Mr. PRICHARD. That is right.

Mr. PACKARD. I was told by an official of the General Petroleum that when a scavenger plant is out of service they had two things that they could do. One of the things they could do, they could dump it into the air as it came out, or they could burn it. Either way causes pollution, but of a little different type.

I asked this gentleman, Mr. Fisher, of the General Petroleum, had he ever thought about closing down the industry and protecting the public's health. He said, "We couldn't do that."

Mr. PRICHARD. Will you just answer my question if you can, Mr. Packard? You say they have an option of doing either 1 of 2 things. When the scavenger plant goes out of operation, does the pollutant go into the air or is it taken care of in some other way?

Mr. PACKARD. It goes into the air.

Mr. PRICHARD. So that if a scavenger plant is broken down 1 day out of every 4, there would be 25 percent of the time during which the casting of pollutants into the air was unrestricted; is that right?

Mr. PACKARD. That is right.

Mr. PRICHARD. That is all.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. No questions.

Mr. ROOSEVELT. Thank you very much, Mr. Packard. We appreciate your presence and your testimony, and we will most certainly look into the facts and the suggestions which you have given to us.

Our next witness will be Dr. Paul Kotin, and before Dr. Kotin comes in I want to take this opportunity, particularly for the benefit of the members of the press, to call their attention to Public Law 159 of the 84th Congress, 1st session, which is the basic law which governs the Federal Government's participation in the control of air pollution. Basically, what it does is to recognize the dangers to the public health and welfare, injury to agricultural crops and livestock, damage to and deterioration of property, and hazards to air and ground transportation from air pollution, and it then goes forward to authorize the Surgeon General, working under the direction of the Secretary of Health, Education, and Welfare, and the Public Health Service, to do certain things particularly in assisting in surveys upon local requests for reports, and to give grants-in-aid to State and local governments and air-pollution control agencies, as well as other public and private agencies and institutions, and to individuals, for research, training, and demonstration projects.

I stress the words "make grants-in-aid to State and local government air-pollution control agencies" in order to emphasize that there is available machinery which, if properly used with sufficient stress, coming not from just local and individual sources, although those are not excluded, from top State control all the way down through the local unit, to get the assistance of the Federal Government, that there is that machinery available.

Now, along that line the committee is now going to hear from two gentlemen specifically in relation to the effects of smog on the public health, with the idea particularly in mind that we should be concerned that any additional appropriation should have a sound basis in fact as to the effect of smog upon public health and, secondly, to emphasize that perhaps the law itself needs to be somewhat changed because, while it gives these duties in relation to public health in the opening paragraph, it lays stress upon recommendations for research programs or devising and developing methods of eliminating or reducing air pollution. There is quite long public record here of the actual work which has been done by the department which I shall be glad to turn over to members of the press if they care to look at it as to the amounts of money which have been allocated to various institutions for research, almost exclusively in the health field, and the committee has had an opportunity to go over that, the committee staff, and we feel that considerable research has been done on the health problem where perhaps less research and less money has been spent upon the specific idea of control and solution of the air-pollution problem itself. I will make those available if the members of the press want to look at them.

Is Dr. Kotin here?

Mr. BISCAILUZ. He was due here at 10 o'clock.

Mr. ROOSEVELT. If Dr. Clarence Mills is here, we will proceed with him. Dr. Mills, will you come forward? We are happy to have you here. I think you met Congressman Steed, from Oklahoma, and Congressman Sheehan, of Illinois, yesterday. Will you raise your right hand and be sworn, please? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. MILLS. I do.

TESTIMONY OF DR. CLARENCE A. MILLS, PROFESSOR OF EXPERIMENTAL MEDICINE, UNIVERSITY OF CINCINNATI

Mr. ROOSEVELT. Would you give your full name, Dr. Mills, to the reporter, and your home address, if you will, sir.

Dr. MILLS. My full name is Dr. Clarence A. Mills. My home address is 2311 Fairview Avenue, Cincinnati 19, Ohio.

As a preamble to the prepared statement already in your hands, I wish to say that I have made 3 trips to Los Angeles in the last 7 months, consulting on the smog problem with the smog committee of the county medical society, with pollution-control officials, with State legislators, and with many others actively at work in various phases of the problem. I have been most happy to make these trips and to spend this time in Los Angeles because this area has the most severe smog problem and is putting forth the most extensive efforts at its eradication. I have felt that there was needed the clearest possible appreciation of the health hazards involved and of their paramount importance in providing the strongest possible impetus to relief efforts. As an example of what Los Angeles residents can do individually to aid solution of this severe community health problem, I would cite one couple whose concern for the health of their own children led them to pay my plane fare for these three trips, I not having the funds under my own research budget to do it. This

couple is Mr. and Mrs. Donald Chivers, of Altadena. I should also like to commend Mr. Royce, of the Huntington Hotel, and Mr. Crowley, of the Town House, for making their facilities at their respective establishments freely available to me on a complimentary basis during these visits.

Now, to go on with the prepared statement already submitted, I will omit repetition of the qualifying background information.

For over 30 years my principal interest has been centered upon climatic and weather effects on man, with the publication of 3 books and many score of scientific articles in this country and abroad. By my participation in Cincinnati's efforts to obtain effective antismoke legislation in 1940, this broad interest in weather effects was shifted to a more specific and direct attack upon the health hazards of polluted air. During the succeeding 15 years my efforts to clarify the health hazards of urban air pollution have taken me into a close study of the subject in many cities of this country, namely, Cincinnati, Pittsburgh, Donora, Cleveland, Detroit, Chicago, Nashville, Birmingham, Atlanta, and Los Angeles, and have resulted in the publication of one book Air Pollution and Community Health and some two score scientific articles.

In a brief summary of these years of keen interest and research in the urban air pollution problem, I would give it as my considered opinion that we have here one of the major community health problems facing this country today, a problem intimately related to our increasing urbanization and ever-expanding mechanization upon a combustion-power basis. Pollution of urban atmosphere with combustion and other aerial wastes has far outrun the natural weather ventilation of many of our urban atmospheres, to a point here in Los Angeles, for instance, where it is imperative that drastic steps be taken as promptly as effective control devices can be developed and produced.

While polluted air can and does damage plant and animal life at times, its major injury is the threat it carries to life and health among human urban populations. This threat may manifest itself in highly fatal acute smog episodes such as the one at Donora, or those now hitting London with increasing frequency and violence, or the several hundred excess deaths occurring right here in the Los Angeles area in close and highly significant association with smoggy periods each year.

Mr. ROOSEVELT. How many did you say? Several hundred?

Dr. MILLS. Yes. Currently the evidence shows about 350 a year excess deaths on the smoggy days of the cardiac and respiratory type that would be logically attributed to the smog itself.

Mr. ROOSEVELT. So you would say that 350 deaths in Los Angeles would be almost directly connected to smog conditions in Los Angeles?

Dr. MILLS. Yes, sir.

Mr. ROOSEVELT. Thank you.

Mr. PRICHARD. That is annually?

Dr. MILLS. Annually. Well, it is on an increasing rate as of this past year. Actually, that figure is for 1954. We didn't have the complete figures in 1955, so we are not quite current at that.

Mr. ROOSEVELT. Would you say, however, that there was any improvement or worsening of the situation from your preliminary look at it in 1955?

Dr. MILLS. We have evidence going back to 1947—1947, 1948, and 1949, and then there is a gap of 1950 and 1951 and 1952, and we begin the evidence again in 1953 and 1954. As of 1949 where the year was completely exposed to view, I think there was something like 235. In 1953 it was at a slightly greater rate, and 1954 at 349, I believe, was the figure but we won't quibble one way or another. It is an approximation.

Exhibit A presented herewith covers my analysis of this significant smog death relationship in the Los Angeles area through recent years.

Mr. ROOSEVELT. Exhibit A will be accepted, without objection, by the committee.

(The material referred to is as follows:)

PREPARED STATEMENT BY DR. CLARENCE A. MILLS, PROFESSOR OF EXPERIMENTAL MEDICINE, UNIVERSITY OF CINCINNATI (SINCE 1930)

QUALIFYING BACKGROUND BIOGRAPHICAL FACTS

A. B., University of South Dakota, 1917; Ph. D. University of Cincinnati, 1920; M. D., same, 1922; Rockefeller Medical Research Fellow, 1922–23; visiting professor at Peking Union Medical College (in China), 1926–28; consultant to United States Army Surgeon General and lecturer at Army Medical Center on tropical heat effects during World War II; consultant to California State Legislative Interim Committee on Air and Water Pollution, 1950–51; etc.

For over 30 years my principal interest has been centered upon climatic and weather effects on man, with the publication of three books and many score of scientific articles in this country and abroad. By my participation in Cincinnati's efforts to obtain effective antismoke legislation in 1940, this broad interest in weather effects was shifted to a more specific and direct attack upon the health hazards of polluted air. During the succeeding 15 years my efforts to clarify the health hazards of urban air pollution have taken me into a close study of the subject in many cities of this country; namely, Cincinnati, Pittsburgh, Donora, Cleveland, Detroit, Chicago, Nashville, Birmingham, Atlanta, and Los Angeles and have resulted in the publication of one book, Air Pollution and Community Health and some twoscore scientific articles.

In a brief summary of these years of keen interest and research in the urban air pollution problem, I would give it as my considered opinion that we have here one of the major community health problems facing this country today—a problem intimately related to our increasing urbanization and ever-expanding mechanization upon a combustion-power basis. Pollution of urban atmosphere with combustion and other aerial wastes has far outrun the natural weather ventilation of many of our urban atmospheres, to a point here in Los Angeles, for instance, where it is imperative that drastic steps be taken as promptly as effective control devices can be developed and produced.

While polluted air can and does damage plant and animal life at times, its major injury is the threat it carries to life and health among human urban population. This threat may manifest itself in highly fatal acute smog episodes such as the one at Donora, or those now hitting London with increasing frequency and violence, or the several hundred excess deaths occurring right here in the Los Angeles area in close and highly significant association with smoggy periods each year. Exhibit A presented herewith covers my analysis of this significant smog-death relationship in the Los Angeles area through recent years. These smog deaths are mostly among people with already damaged heart and respiratory tissues, in whom even mild swelling from the irritating smog is more than the damaged system can stand.

Increasing concern is now being shown for the more chronic forms of polluted air damage in air passages and lungs, damage which does not immediately kill but causes slow impairments of function leading to emphysema, certain forms of asthma, and a growing semiinvalidism. These more chronic forms of damage are more difficult to identify and study in population masses because they do not kill. One of them, lung cancer, is highly fatal, however, and has been taken as perhaps the best general index of polluted air damage to exposed persons, and its rapidly increasing prominence as a cause of death among urban populations has given rise to acute concern in many parts of the world where mechanized

urbanization on a combustion-power basis has brought increasing air pollution problems.

We know now that three types of air pollution lie behind the alarming increases in lung cancer death rates—tobacco smoking, motor-exhaust fumes, and general urban air pollution. It seemed to me imperative that these three factors be separately evaluated in their relationship to lung cancer causation and I accordingly present exhibit B which covers the results of a survey just completed in Ohio and designed to provide such separate evaluation. It is not my intention here to stress tobacco smoking's relation to lung cancer per se, but there can no longer be any question that tobacco smoking is significantly associated with heightened lung cancer incidence and that most men smoke. Therefore, any effort to assess the lung cancer-promoting effects of other forms of air pollution must of necessity take the tobacco-smoking habits into account and enter due corrections therefor.

Exhibit B speaks for itself, but I may say in very brief summary that here for the first time exposure to motor-exhaust fumes is shown to double or triple the lung cancer rates already heightened by tobacco smoking. Exposure to general urban air pollution, in addition, brings a further doubling of the already high rates and indicates a health hazard of truly serious proportions for these people exposed to the combined air-pollution damages. For nonsmoking populations living in clean air and little exposure to urban motor traffic fumes, lung cancer remains a disease of insignificant proportions and virtually the same in both sexes, but for the smoker living in polluted air and driving extensively in urban traffic the respiratory hazards pyramid in serious fashion.

While my Ohio survey covered by exhibit B provides definite and significant information along these lines, severe limitation of research funds so restricted its size as to give inadequate coverage to many of its more detailed points. There is urgent need for a large-scale survey along this same pattern, covering three or more of the country's large urban centers and certainly including Los Angeles where motor-exhaust fumes constitute so large a part of the total air pollution problem. My Cincinnati survey must be considered more as a pilot survey, but it is highly significant that even this pilot investigation should expose such significant relationships.

As my final emphasis on the seriousness of polluted air for man, I would offer exhibit C, a recent paper by Otto Warburg on the Origin of the Cancer Cell, translated and published by members of the staff of the National Cancer Institute. Dr. Warburg has for 30 years been the world's leading authority on metabolic processes within the cell, and in this article he discusses the damage to enzymes and catalysts within the cell wrought by pollutants commonly found in urban air (ozone, nitrogen oxides, sulfur gases, several hydrocarbon compounds, etc.). These pollutants may cause acute swelling and death of cells lining the air passages; but if the cell is damaged but does not die, then its enzymes and catalysts undergo internal changes always pushing farther along the road to becoming a cancer cell. Isolated but repeated damaging episodes push such cells always nearer to the stage of real cancer—here is a point for real concern among populations subject to intermittent smog episodes; a few may die of acute damage in each episode but the many are also suffering hidden and cumulative damage.

It should be of interest here that those most interested in industrial health (the health of in-plant workers) have recently reconsidered the longer-term injurious possibilities of ozone and have dropped its maximal allowable limits for in-plant workers from 1.0 part per million down to 0.1 part per million. Further discussion on this point is carried in my exhibit A.

In closing, I would say that this problem of the health hazards of polluted air warrants all the attention and study that can be given to it in the months and years ahead. We are beginning to see the seriousness of the situation and the extent of a few of the health hazards, but to fill in the finer details of the picture will require much further work and money.

EXHIBIT A

RESPIRATORY AND CARDIAC DEATHS IN LOS ANGELES SMOGS

By C. A. Mills, M. D., Ph. D., professor of experimental medicine, University of Cincinnati

In order to be doubly certain that Los Angeles smogs carry a significant hazard to community life, we have given careful reappraisal to the 1947–49 data treated briefly in a former publication (1). Also these older findings have been strongly reinforced and broadened by the addition of data from more recent years (1953–55). It now seems clear that residents of the Los Angeles area are facing very considerably and serious respiratory hazards in breathing their smoggy air at its present levels of pollution. These hazards seem to arise mainly from the presence within their atmospheric "mixing bowl" of ozone or total oxidant concentrations now recognized as dangerously irritative to the human air passages.

It is obvious that maximal allowable pollution of community atmospheres should be kept below the exposed population's sickness and death threshold. Such threshold limits have been carefully worked out for industrial in-plant workers—workmen's compensation laws made this almost mandatory by holding management liable for any such worker health damage. Such limits have never been determined for outside community populations, however, nor can the limits established for 8-hour daily in-plant exposure of healthy workers be transposed safely to the 24-hour day, day-after-day, exposure of community residents. Discussion of this point at 1 symposium (2) brought out hints that the in-plart limits are probably 4 to 20 times higher than those to be considered safe for continuous community exposure. This is especially true where the polluting materials possess irritational effects in the air passages which lead to progressive and accumlative damage.

Table I presents a general month-by-month summary of the 1947–49 data on day-by-day respiratory and cardiac deaths in Los Angeles county as related to the Stanford Research Institute's smog index. The data on deaths were supplied by the State health department and the smog index information was supplied by the Stanford Research Institue in the form of a continuous graph. The data of table I appear particularly significant for the year 1949, so this year's data were subjected to the following more detailed handling.

In order that the whole year's data might be thrown together for unified handling, steps were taken to erase all normal seasonal variations in deaths and to counterbalance the last half-year against the first half-year for the steadily rising population numbers. All months were equalized to the mid-year (July) average of 42 deaths per nonsmoggy day. This meant that all death numbers in September were increased by 1, those of October decreased by 2, those of November decreased by 4, etc., for all other months of the year. Normal seasonal influences (not related to smog) were thus erased and the second half year counterbalanced the first half year in population change effects. Any day-to-day smog effects on deaths were left undisturbed throughout the year and thus the whole year's mass of data could now be subjected to unified analysis.

Table 2 presents the results of this analysis of the equalized 1949 data, results indicating a relationship between smoggy days and increased respiratory and cardiac deaths of such degree of statistical significance as to render its occurrence by chance alone as very improbable. Table 2 also presents a similiar analysis of data for a more recent period (August 17, 1953, to August 31, 1955), showing again a significant smog-death relationship quite unlikely to occur by the operation of chance alone. Death data for this period was supplied by the State health department, while the continuous graphic data on the daily maximums of total oxidant were kindly supplied by Professor Haagen-Smit. Preliminary sorting of the day-by-day death data for individual months of this more recent period indicated that daily oxidant maxima above 0.2 were associated with increases in the daily death averages, so it was considered that

days with oxidant maximums of 0 to 0.2 should be taken as the nonsmoggy controls.

Also in table 2 are shown the results of the breaking down of the death data into those occurring at or above age 65 and those occurring in the earlier age decades. Although not all the findings here are as significant as with the total life-span deaths, still they are all positive and indicate that the smog effects are exerted in the younger as well as the more elderly population fractions.

Since the 1949 associaion was between deaths and the Stanford Research Institute's smog index, and since the smog index is based upon meteorological factors predisposing to smog formation rather than upon actual air analysis of polluting materials, it seems advisable to relate the SRI index directly with actual air analysis. Fortunately Mr. Bartel of the United States Rubber Co. has supplied us with ozone maximums for 148 days of 1949 (4). Table 3 indicates the highly significant relationship existing between these ozone values and the SRI smog index values.

Recent emphasis (5) has been given to evidences of ozone toxicity for bacteria, molds, experimental animals and human beings, with the result that maximum allowable concentrations considered safe for industrial in-plant workers were lowered in 1954 (6) from the former 1.0 parts per million to 0.1 parts per million (barely detectable by those with a keen sense of smell). Levels of 0.2 parts per million definitely increase guinea-pig death rates over 7 to 8 months of exposure, while these animals also seem slightly harmed even by 0.1 parts per million concentrations over many months of continuous exposure (7). Bacterial and mold growth is inhibited by 0.2 parts per million ozone concentration.

Ozone toxicity manifests itself in animals and people primarily by irritation and swelling in the cells lining the air passages. Such swelling in the smallest air passages next to the lung's air sacs interferes seriously with their proper ventilation and is the direct cause of death. Other toxic materials such as sulfuric acid mists or the oxides of nitrogen may act similarly in the air passages. Just what connection there may be between such cellular irritation and the generation of lung cancer is not known, but it is significant that such toxicity in most cases means direct interference or blockage of many of the intracellular enzymatic and catalytic systems that form the basis of the vital cellular processes.

The evidence of slow respiratory tract damage in healthy animals continuously exposed for months to ozone concentrations as low as 0.2 parts per million (or even 0.1 parts per million) makes it really imperative that respiratory and cardiac sicknesses and deaths be closely examined for the recent years of steadily worsening smogs in the Los Angeles area. Even without any further evidence than is here presented, there seems ample justification for the imposition of a firm smog-control program aimed at the prevention of atmospheric ozone concentrations above 0.2 parts per million (and perhaps even lower) when the area shall have reached complete development.

There no longer exists a reasonable doubt that Los Angeles smogs are indeed related to very considerable increases in respiratory and cardiac deaths. In no adequate test period were these deaths less frequent on smoggy days than on nonsmoggy days—always the mean number of such deaths was found to be greater on the smoggy days of every test period. Nor are such excess deaths limited to elderly people—younger age groups also share significantly in the smog hazards.

In sum total, this Los Angeles smog hazard is represented by 230 excess respiratory and cardiac deaths in the year 1949, by 281 in the last 137 days of 1953, by 334 in the year 1954, and by 159 among those age 65 and over during the first 8 months of 1955 (this not including the year's severe smog season). It should be borne clearly in mind that this is merely one measurable index of smog damage, that its total of nonfatal ill-health and chronic damage in the respiratory tract must far outweigh these deaths in community importance.

If we add to these Los Angeles findings the Cincinnati survey results clearly relating lung cancer incidence to exposure to urban motor exhaust fumes and general air pollution, we begin to see the outlines of a community health hazard calling for the most effective remedial measures available. The Los Angeles situation is indeed so severe and so frought with health hazards to the area's residents, that any pollution-control program should be put on the compulsory health basis, that alone can provide it with the necessary overriding authority.

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2. Air Pollution; Proceedings of the United States Technical Conference on Air Pollution, pp. 470–473, published by McGraw-Hill Book Co., Inc., New York, 1952.

3. Stanford Research Institute's interim reports on the smog problem in Los Angeles County, published by the committee on smoke and fumes of the Western Oil and Gas Association, Los Angeles, 1948–50.

4. Personal communication from A. W. Bartel of the United States Rubber Co., for Los Angeles individual maximum ozone values in 1949—published in summary form by A. W. Bartel and J. W. Temple, Industrial and Engineering Chemistry, 44, 857, 1952 (April).

5. Stokinger, Herbert E., Ozone Toxicity: * * *, A. M. A. Arch. Indust. Hyg., & Occup. Med., 9, 366–383, 1954 (June).

6. Threshold Limit Values for 1954, Ibid., 9, 530, 1954 (June).

7. Wilska, S., Ozone: Its Physiological Effects, etc., Acta Chem. Scandinav., 5, 1359, 1950. Thorp, C. E., Toxicity of Ozone, Indust. Med., 19, 49, 1950.

TABLE I.—*Relation of Los Angeles smogs to daily cardiac and respiratory deaths* (3)

Year and month	Clear or mildly smoggy days (SRI smog index 0–5)		Moderately smoggy days (SRI smog index 6–9)			Severely smoggy days (SRI smog index 10+)		
	Number of days	Deaths, daily average	Number of days	Deaths, daily average	Total excess	Number of days	Deaths, daily average	Total excess
1947—January	29	43.8	0	0	0	2	50.5	+13.4
February	26	47.7	1	58.0	+10.3	1	44.0	−3.7
March	31	43.7	0	0	0	0	0	0
April	29	41.6	0	0	0	1	63.0	+21.4
May	29	40.0	0	0	0	2	47.0	+14.0
June	30	36.8	0	0	0	0	0	−0
July	26	38.3	1	34.0	−4.3	4	42.8	+18.0
August	31	38.6	0	0	0	0	0	−0
September	22	38.6	5	35.4	−16.0	3	40.7	+6.3
October	29	38.6	0	0	0	2	35.0	−7.2
November	28	44.2	0	0	0	2	58.0	+27.6
December	31	52.7	0	0	0	0	0	0
Year	341	42.1	7		−10.0	17		+89.8
1948—January	29	61.5	1	82.0	+20.5	1	80.0	+18.5
February	29	50.5	0	0	0	0	0	0
March	31	47.5	0	0	0	0	0	0
April	30	44.0	0	0	0	0	0	0
May	30	40.0	0	0	0	1	48.0	+8.0
June	30	39.2	0	0	0	0	0	0
July	26	37.4	5	34.2	−16.0	0	0	0
August	24	37.2	5	36.0	−6.0	2	41.0	+7.8
September	15	34.1	4	39.0	+19.6	11	39.2	+56.1
October	23	37.6	6	35.2	−14.4	2	43.0	+10.8
November	26	42.6	3	35.7	−20.7	2	42.0	−.6
December	31	50.6	0	0	0	0	0	0
Year	324	43.2	24		−17.0	18		+100.6
1949—January	31	54.7	0	0	0	0	0	0
February	25	54.6	3	57.3	+8.1	0	0	0
March	30	51.0	1	68.0	+17.0	0	0	0
April	20	45.6	9	46.9	+11.7	1	53.0	+7.4
May	29	44.3	1	52.0	+7.7	1	52.0	+7.7
June	27	43.0	3	45.7	+8.1	0	0	0
July	28	42.1	2	44.5	+4.8	1	40.0	−2.1
August	16	42.7	13	43.8	+14.3	2	39.0	−6.4
September	14	40.8	7	44.3	+24.5	9	49.1	+74.7
October	22	44.3	5	46.2	+9.5	4	53.5	+36.8
November	17	45.7	5	45.8	+.5	8	52.6	+55.2
December	26	50.4	3	56.3	+17.7	2	50.5	+.2
Year	285	47.9	52		+123.9	28		+173.5

NOTE.—See reference 3 for details.

TABLE II.—*Statistical analysis of smog-death relationships in Los Angeles*

Time period	Pollution index	Deaths, mean number	Smog deaths of mean	Number of days	Pollution index	Deaths, mean number	Smog deaths of mean	Number of days	Difference of means	Smog excess of difference	Difference, smog excess	Chi square X 2	Number of excess deaths
1949	SRI 0–5	42.00	7.33	285	SRI 6 and over	44.88	7.32	80	2.88	0.93	3.1	3.94	230
1953: Aug. 17 to Dec. 31	Oxidant 0–0.2	45.61	8.69	61	Oxidant 0.3 and over.	49.30	8.50	76	3.70	1.48	2.5	5.18	281
		50.0220				52.2940			2.2720	.7955	2.9 (1–300)	4.8 (3–100)	
1954	do	49.81	8.47	169	Oxidant 0.3 and over.	51.52	7.50	196	1.71	.84	2.02	3.85	334
1955, to Aug. 31	do	[1] 35.96	6.65	125	do	37.31	7.02	118	1.35	.87	1.55	.61	159
1953: August, September, October.	do	[2] 12.59	4.50	17	do	15.57	4.24	59	2.55	1.22	2.10	.90	
Do	do	[3] 32.00	4.85	17	do	35.73	7.45	59	3.73	1.52	2.44	4.74	
1954: August, September, October.	do	[2] 15.37	3.59	19	do	17.03	3.62	73	1.66	.93	1.80	1.38	
Do	do	[1] 32.26	7.34	19	do	34.12	5.79	73	1.86	1.81	1.03	1.38	

[1] Age 65 and over.

[2] Under age 65.

[3] Over age 65.

TABLE III.—*Relation of smog index (3) to ozone concentration in air (4)*

SRI smog index	Number of test days	Ozone parts per 100 million of air				
		Average	Mean	Smog deaths, mean	Difference in mean, smog excess difference	X 2 values
0	23	9.7				
1	21	16.0	13.00	8.21		
2	25	22.8				
3	12	22.3			5.91	22.5
4	15	23.3				
5	8	28.2	23.36	9.64		
6.7	16	35.5			8.08	19.6
8.9	10	37.1				
10+	18	41.6	39.27	10.08		
All	148					

Dr. MILLS. These smog deaths are mostly among people with already damaged heart and respiratory tissues, in whom even mild swelling from the irritating smog is more than the damaged system can stand.

Increasing concern is now being shown for the more chronic forms of polluted air damage in air passages and lungs, damage which does not immediately kill but causes slow impairments of function leading to emphysema, certain forms of asthma, and a growing semiinvalidism. These more chronic forms of damage are more difficult to identify and study in population masses, because they do not kill.

It so happens that death is a very definite event for most people, and for statistical purposes also, so that one of them, lung cancer, is highly fatal, however, and has been taken as perhaps the best general index of polluted air damage to exposed persons, and its rapidly increasing prominence as a cause of death among urban populations has given rise to acute concern in many parts of the world where mechanized urbanization on a combustion-power basis has brought increasing air pollution problems.

We know now, going on with the lung cancer situation as an index, we know now that three types of air pollution lie behind the alarming increases in lung-cancer death rates—tobacco smoking, motor-exhaust fumes, and general air pollution. I separate those, because my survey was made in Cincinnati where we have a chance to study them separately, what you do not have here. Well, you would have greater difficulty. I think a survey here could show it, but it would be more difficult, and it would have to cover a broader base.

It seemed to me imperative that these three factors be separately evaluated in their relationship to lung-cancer causation, and I have accordingly presented exhibit B, which covers the results of a survey just completed in Ohio and designed to provide such separate evaluation. It is not my intention here to stress tobacco smoking's relation to lung cancer per se, but there can no longer be any question that tobacco smoking is significantly associated with heightened lung-cancer incidence and that most men smoke. Therefore, any effort to assess the lung-cancer promoting effects of other forms of air pollution must of necessity take the tobacco-smoking habits into account and enter due corrections therefor.

Mr. ROOSEVELT. Exhibit B will be accepted, without objection, by the committee.

(Exhibit B is as follows:)

EXHIBIT B

TOBACCO SMOKING, MOTOR EXHAUST FUMES AND GENERAL AIR POLLUTION IN RELATION TO LUNG CANCER INCIDENCE

By Clarence A. Mills, M. D., and Marjorie Mills Porter, M. D., Laboratory for Experimental Medicine, University of Cincinnati

Rapidly rising incidence and death rates from lung cancer have now brought this disease into the pandemic category (1) and rendered imperative a searching evaluation of all major causative factors. Amelioration or removal of such causative factors seems necessary for control of the disease's advance, for only in a minor percentage of cases is diagnosis made early enough for surgery to be curative. The survey results here presented afford the first separate evaluation of the major factors most closely associated with the disease incidence and for the first time indicate a major role for motor exhaust fumes.

The finger of suspicion has now been pointed most strongly at three types of pollution—tobacco smoke, motor exhaust fumes, and general urban air pollution. Certain occupational dusts and fumes have been shown to be closely associated with lung cancer in exposed workers, but the total of all such occupational cancers is insignificant amid the disease's widespread prevalence today. On the other hand, tobacco smokers seem definitely more prone than nonsmokers to develop this type of cancer; and its overall prevalence among industrialized urban populations—more exposed to motor exhaust fumes and general air pollution—is four-fold higher than among rural residents. It is most unfortunate that many proponents of tobacco smoking etiology have disregarded the probability that all factors are working together to pyramid the disease incidence in areas of atmospheric pollution and in the more exposed sex (male being more exposed to all factors).

In reporting our 1946 studies (2) showing lung cancer to be twice as prevalent among men living in polluted industrial areas as in the cleaner suburbs of Chicago and Cincinnati, we remarked: "One would be inclined to look elsewhere for a factor which is working synergistically with outdoor air pollution to affect the respiratory tracts of men in particular. One at once thinks of tobacco smoke in this connection, for the percentage of men who smoke is almost three times as great as that of women. It is therefore quite possible that the really alarming respiratory hazard men face in urban areas of heavy air pollution may be due to the combined and cumulative effects of such pollution in conjunction with the chronic irritational action of tobacco smoke."

Stocks later reported (3) a direct relationship of lung cancer prevalence to size of city and to urban population density in Britain, remarking: "The facts—seem to fit in with the hypothesis that atmospheric pollution by smoke is an important factor on which tobacco smoking is interposed. This would mean, in effect, that smoking is more dangerous to a town dweller than to a country dweller".

Materials clearly cancerigenic for experimental animals have been isolated from polluted city atmospheres (4), from tobacco smoke (5), from motor exhaust fumes (6), and from the smoky burning of a large variety of organic materials. Thus when statistical studies show a direct parallelism between lung cancer prevalence in men and the degree of air pollution prevailing in the air they breathe, there would seem to be grounds for a strong suspicion that these known cancerigenic agents in the polluted air are working slowly through the years. In Chicago, for instance, we found lung cancer death rates in men to reach their peak a full decade earlier in life among men living in the city's most polluted districts than among those living in its cleaner suburbs (2).

Worldwide attention has recently been focussed upon the tobacco smoking aspects of lung cancer causation by two publications, one in America (7) and one in Britain (8). These two publications set forth the results of the most extensive smoking-cancer surveys yet conducted with results generally verifying the more limited previous surveys of many other investigators. All agree in showing lung cancer to be sharply more prevalent among smokers than nonsmokers. Unfortunately, however, all share also a common failure to consider the part other forms of air pollution may have played in the lung cancer causation under study by them. Their surveys in every case were carried out quite devoid of controls which might have segregated (in part at least) the tobacco smoking and the polluted air factors in the disease causation.

OHIO URBAN-RURAL SURVEY

In planning a survey which would incorporate adequate controls for separate evaluation of the major factors, we designed it to cover three contracting Ohio population groups, the dirtier basin districts of Cincinnati, the city's cleaner suburbs, and rural populations living in the cleaner country air of the State's rural counties. Items of information covered in the survey included sex, age, color, place, and duration of residence, occupation, tobacco smoking history and an estimate of annual motor travel mileage. Survey information on living populations was obtained either by house visitation or by telephone call to every third consecutive household on the streets or roads covered. Final tabulations include only those with at least 10 years' residence in the given area. Numbers at risk and death rates in the various categories were obtained by proportionate projection of the survey numbers upon that area population as recorded in the 1950 census. Information on those dying of respiratory tract cancer during the 9-year period (1947–55) was obtained directly from the death certificates, from hospital records and from relatives or friends. Positive histories were obtained for 76 percent of all those cancer victims in the urban districts and about 20 percent in the rural areas. Throughout this article the term "lung cancer" is loosely used to denote all cancers of the respiratory tract (No. 161–4 of the International List of Causes of Death).

Table I summarizes the survey findings for men of Cincinnati's cleaner suburban areas (Census tracts 45–59, 62–5, 73, 75, 79–85, 93–102, 105–9). Numbers of cancer deaths listed were calculated as per 100,000 population per year" and only for those categories containing more than two listed deaths with positive survey history. Cancer deaths without obtainable history were apportioned in each age-decade to the various smoking and motor travel categories on the same distributional basis found prevailing among those yielding positive histories. All death rates listed thus represent annual averages for the 9 years, 1947–55. Data on amounts of tobacco smoked and on mileage of motor travel necessarily represent rather crude estimates by the reporting individuals, so that the survey results are of much more value in a gross qualitative than in an exact quantitative sense. These are faults common to all mass population surveys based upon memory reporting instead of actual written records. While larger survey numbers would have been desirable, it is doubtful if the significance of the findings would have been enhanced.

By restricting the tabulation in table I to age decades from 40 years upward, we were able to deal mainly with stabilized smoking experiences of 15 years or more. Any individual who had quit smoking less than 10 years previously was listed according to his earlier smoking habits. Smoking combinations including cigarettes were listed always under the appropriate cigarette category. Cigarette smoking was recorded as light if the daily number of cigarettes smoked ranged from 1 to 14 (anything less than ¾ pack), as moderate if the daily number ranged from ¾ to 1¾ packs and as heavy if 2 packs a day or more. For those smokers "rolling their own," 1 bag of tobacco was considered as the equivalent of 1 pack of ready-made cigarettes.

Inspection of tabe I shows, first, that tobacco smoking is unquestionably and significantly related to increased lung cancer incidence and, secondly, that the heightened lung cancer rates in every smoking category with adequate case numbers are further sharply increased for suburban Cincinnati men traveling 12,000 miles or more a year in motor traffic. Most closely involved are drivers of trucks, buses, taxis, and salesmen, appraisers or men of other occupations requiring many hours each day of exposure in motor traffic. This effect of motor traffic exposure shows up most clearly among moderate cigarette smokers in all age decades where case numbers are greatest and the findings most stable. When all age-decades are lumped together to give still more adequate numbers, nonsmokers and light smokers show a 50 to 60 percent increase with heavy motor traffic exposure, while moderate cigarette smokers show a 2- to 3-fold increase. Heavy cigarette smoking seems in itself to product maximal increase in lung cancer incidence and to leave its population segments incapable of response to the additional hazards of motor traffic exposure.

Table 2 carries the summated data on white males of Cincinnati's more polluted basin district (Census tracts 1–29, 43–4, 60–1, 74, 76–8, 86–7, 90–1, 103–4). Here are seen the same general relationship of tobacco smoking and motor traffic exposure to lung cancer incidence but with certain significant variations from the rates shown in table I for the city's cleaner districts. First the lung cancer death rate is lower among basin nonsmokers than among suburban nonsmokers, quite contrary to initial expectations and most probably related to

their lesser traffic exposure (roughly half as many miles of traffic exposure annually as was experienced by the suburban nonsmokers). Secondly, all grades of cigarette smoking are associated with greater increases in lung cancer hazard among basin men with low traffic exposure than among similar classes living in the city's cleaner suburbs. And thirdly, urban traffic exposures of over 12,000 miles a year bring greater enhancement of lung cancer hazards to men living in the more polluted basin districts than to residents of the city's cleaner suburban areas.

Table 3 carries the survey data on white males of 18 Ohio rural counties located at least 40 miles from sizable industrialized urban centers (Adams, Brown, Coshocton, Darke, Defiance, Geauga, Highland, Hocking, Holmes, Mercer, Monroe, Morgan, Noble, Perry, Van Wert, Vinton, Williams). The rural living-population survey was limited to residents of Brown County lying 40 to 60 miles east of Cincinnati and with no city of as much as 2,500 population. In order to obtain even minimal numbers of lung cancer deaths in the survey, a list of all such recorded deaths for the 9-year period, 1947–55, was first obtained from the State vital statistics section, names of victims and next of kin from county records so far as possible for direct queestioning, with final recourse to the records of practicing physicians in the counties listed. This phase of the rural survey will not be completed for some time, but the results already at hand seems worthy of presentation at this time.

Rural men exhibit roughly the same percentage increase in lung cancer hazard with the various forms of tobacco smoking as was shown for the basin and suburban districts of Cincinnati. High mileages of motor travel (mostly in the light traffic of country districts) showed no significant evidence of increasing lung cancer hazards in any smoking category. This would seem to be a most important finding, indicating that the lung cancer hazard arises not merely from miles driven but from this in association with traffic density and exhaust fume concentration.

Tables 4, 5, and 6 present the survey data on white females of Cincinnati's clean suburban districts, of the city's more polluted basin districts, and of clean rural districts, respectively. No statistically significant differences are noted in the lung cancer hazards of these three contrasting groups of white women with respect to any of the etiological factors so strongly at work among the male populations. It is of still greater importance that nonsmoking men of rural areas and of Cincinnati's basin districts (with low traffic exposure) exhibit lung cancer hazards not significantly different from those of the female populations. It may well be inferred that greater average of exposure to urban traffic fumes is responsible for the slight elevation of lung cancer hazard among nonsmoking men of the Cincinnati cleaner suburban areas. On the basis of these observations, the tentative conclusion seems justified that there exists no essentially sexual difference in susceptibility to lung cancer.

Here for the first time we see for all age decades above 40 years, the relation of the various forms of tobacco smoking to lung cancer incidence and superimposed thereon the additive influences of general air pollution and of exposure to motor exhaust fumes. Under standard conditions of age, sex, and air pollution other than tobacco smoke, it appears that pipe and cigar smoking is associated with a 2- to 3-fold increase in lung cancer, light cigarette smoking with a somewhat lesser increase, moderate cigarette smoking with a 4- to 6-fold increase, and heavy cigarette smoking with a 10- to 20-fold increase. Exposure to motor exhaust fumes for over 12,000 miles a year of urban traffic driving seems associated with a further 2- to 3-fold increase in lung cancer hazard for men of all smoking categories, while the still further addition of general urban air pollution is associated with a further doubling of hazards already existing in association with the other two factors. It is significant that extensive motor travel in dominantly rural areas carries no addition to the lung cancer hazards.

The only other survey at all approaching this one in complete coverage of all major factors associated with lung cancer incidence is that of Stocks et al. (9) in England. It is unfortunate that Stocks and his coworkers used hospital and clinic patients as representative of the urban and rural populations, instead of making actual house-to-house surveys as we have now done.

The errors of expecting hospital patients to represent the general populations from which they are derived have already been emphasized (10).

Easteott's survey, showing a much lower lung cancer incidence in native New Zealand residents than in those derived from British migration (12) seems to demonstrate in the British migrant there the influences we have here shown to be associated with urban life (motor exhaust fumes and general urban air pollution) superimposed upon tobacco smoking habits.

DISCUSSION

Most timely and of great significance in today's serious lung cancer situation is Otto Warburg's recent paper, On the Origin of Cancer Cells (11). In it Warburg presents the case for nonspecific and irreversible damage to intracellular enzymatic and catalytic systems of the mitochondria as the first step in the change from a normal to a cancer cell. Such changes in mitochondrial metabolism have been show to hold indefinitely through many succeeding cellular generations and to become progressively greater with repetition of the damaging episodes. Labile sulf-hydril linkages and susceptibility to oxygen want by cellular respiratory systems make the epithelial tissues lining the air passages very vulnerable indeed to such intracellular damage from polluting materials in the air breathed.

Herein lies a possible and very disturbing explanation of the associations now shown to exist between the various forms of air pollution and the rising lung cancer incidence. The urbanization and motorized mechanization upon which today's civilization is based thus seems to be encountering health hazards of considerable magnitude. Before the days of effective antibiotic and chemotherapy, pneumonia and tuberculosis exhibited the same close relationship to polluted air as is found for lung cancer. Today lung cancer is the greatest killer among respiratory diseases and is rapidly growing in stature as a health problem. Other forms of chronic, nonfatal damage from breathing polluted air (emphysema, for instance) carry a much greater overall health threat than does lung cancer but are more difficult in quantitation because they are less clear-cut and do not directly kill.

Air pollution's mass killing episodes (Belgium, 1930, Donora, 1948, London, 1948, 1952, and 1956) are more dramatic but of less overall importance than this slower damage to the air passages and lungs. Los Angeles' smoggy days are immediately associated with an excess of some 350 respiratory and cardiac deaths each year as compared to the year's least smoggy days, and yet still more importance is to be attached even there to the more chronic types of pollution damge slowly leading on to the initiation of emphysema and cancer.

We must now consider that each nonfatal exposure to polluted air damage produces irreversible and irrepairable cell damage in the respiratory system which accumulates through the years with repetition of the exposure episodes. This community health problem thus differs sharply from those associated with infectious disease where tissue recovery is usually complete following each damaging episode. The irreversible and accumulative damage from breathing polluted air renders imperative an entirely new evaluation of pollution levels safely allowable for exposed persons. Immediate damaging effects in the respiratory system can no longer serve as the criterion of safety; we must now consider the likelihood that repeated but isolated exposures may eventually lead to accumulated cellular changes of serious importance.

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TABLE 1.—*Cincinnati clean suburban areas—male white only, 1950 census, 1947–55 lung cancer deaths*

Traffic exposure miles/year	Nonsmokers			Pipe and cigar			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 to 49; population, 12,380:																		
Surveyed	34	0	.....	13	1	.....	20	2	.....	130	9	15.2	11	5	99.9	208	17 (3)	18.0
<12,000 miles	26	0	.....	11	1	.....	17	2	.....	106	5	10.1	6	3	.....	166	11	14.6
>12,000 miles	8	0	.....	2	0	.....	3	0	.....	24	4	36.6	5	2	.....	42	6	31.4
Age group, 50 to 59; population, 11,347:																		
Surveyed	43	3	17.8	22	5	58.3	25	4	41.0	89	32	92.1	6	14	599.7	185	58 (24)	80.3
<12,000 miles	37	1	.....	19	5	.....	23	2	.....	75	24	82.0	2	6	.....	156	38	62.3
>12,000 miles	6	2	.....	3	0	.....	2	2	.....	14	8	146.3	4	8	.....	29	20	176.5
Age group, 60 to 69; population, 7,518:																		
Surveyed	25	9	65.5	22	4	33.1	18	7	71.7	26	32	223.8	3	16	769.6	94	68 (21)	131.5
<12,000 miles	19	8	.....	19	3	.....	17	5	.....	23	23	181.7	3	11	.....	81	50	112.3
>12,000 miles	6	1	.....	3	1	.....	1	2	.....	3	9	545.5	0	5	.....	13	18	251.7
Age group, 70 plus; population, 4,243:																		
Surveyed	15	5	63.7	28	22	149.3	4	7	332.3	10	14	266.2	0	7	.....	57	55 (15)	183.3
<12,000 miles	15	4	.....	23	21	.....	3	7	.....	7	10	271.5	0	7	.....	48	49	193.5
>12,000 miles	0	1	.....	5	1	.....	1	0	.....	3	4	242.9	0	0	.....	9	6	126.7
Age group, 40 to 59; population, 23,727:																		
Surveyed	77	3	9.8	35	6	42.8	45	6	33.3	219	41	40.9	17	19	288.9	393	75 (27)	47.8
<12,000 miles	63	1	.....	30	6	.....	40	4	.....	181	29	40.1	8	9	.....	322	49	38.1
>12,000 miles	14	2	.....	5	0	.....	5	2	.....	38	12	79.0	9	10	.....	71	26	91.7
Age group, 60 plus; population, 11,761:																		
Surveyed	40	14	64.7	50	26	96.1	22	14	117.4	36	46	235.7	3	23	1,412.1	151	123 (36)	150.2
<12,000 miles	34	12	65.1	42	24	105.4	20	12	110.7	30	33	203.0	3	18	1,105.1	129	99	141.5
>12,000 miles	6	2	.....	8	2	.....	2	2	.....	6	13	400.0	0	5	.....	22	24	201.3

See footnote at end of table

TABLE 1.—*Cincinnati clean suburban areas—male white only, 1950 census, 1947–55 lung cancer deaths*—Continued

Traffic exposure miles/year	Nonsmokers			Pipe and cigar			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 plus; population, 35,488:																		
Surveyed	117	17	32.6	85	32	84.5	67	20	67.4	255	87	76.6	20	42	471.3	544	198 (63)	81.7
<12,000 miles	97	13	30.1	72	30	93.6	60	16	59.8	211	62	65.9	11	27	550.7	451	148	78.2
>12,000 miles	30	4	44.9	13	2	.....	7	4	128.5	44	25	127.6	9	15	374.2	93	50	120.7

NOTE.—Numbers in parenthesis indicate cases with incomplete history. Rates given are lung cancer deaths per year per 100,000 population at risk.

TABLE 2.—*Cincinnati Basin areas male white only, 1950 census, 1947–55 lung cancer deaths*

Traffic exposure miles/year	Nonsmokers			Pipe and cigars			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 to 49; population, 10,544:																		
Surveyed	21	2	.....	6	0	.....	5	0	.....	82	8	15.5	9	16	282.3	123	26(6)	33.5
<12,000 miles	20	1	.....	6	0	.....	5	0	.....	68	5	11.7	8	12	238.1	107	18	26.7
>12,000 miles	1	1	.....	0	0	.....	0	0	.....	14	3	33.9	1	4	.....	16	8	79.4
Age group, 50 to 59; population, 8,993:																		
Surveyed	20	1	.....	14	3	34.3	7	4	91.4	48	41	136.8	12	18	240.4	101	67 (19)	106.2
<12,000 miles	18	1	.....	13	3	.....	6	4	.....	44	34	123.8	11	11	160.2	92	53	92.3
>12,000 miles	2	0	.....	1	0	.....	1	0	.....	4	7	280.5	1	7	.....	9	14	249.3
Age group, 60 to 69; population, 7,189:																		
Surveyed	29	3	16.9	11	7	98.5	9	6	103.1	27	34	194.9	5	22	635.0	81	72 (17)	137.5
<12,000 miles	28	3	.....	10	7	.....	9	6	.....	27	27	154.8	5	18	520.0	79	61	119.5
>12,000 miles	1	0	.....	1	0	.....	0	0	.....	0	7	.....	0	4	.....	2	11	851.7
Age group, 70 plus; population, 4,889:																		
Surveyed	22	7	48.3	19	12	95.9	3	8	404.3	8	13	246.6	1	10	.....	53	50 (13)	143.8
<12,000 miles	22	7	.....	19	10	79.9	3	8	.....	8	11	208.7	1	10	.....	53	46	131.8
>12,000 miles	0	0	.....	0	2	.....	0	0	.....	0	2	.....	0	0	.....	0	4	.....
Age group, 40 to 59; population, 19,587:																		
Surveyed	41	3	11.7	20	3	24.2	12	4	53.7	130	49	60.8	21	34	261.0	224	93 (25)	66.9
<12,000 miles	38	2	.....	19	3	.....	11	4	.....	112	39	56.1	19	23	194.5	199	71	57.9
>12,000 miles	3	1	.....	1	0	.....	1	0	.....	18	10	89.6	2	11	888.2	25	22	141.9

See footnote at end of table

TABLE 2.—*Cincinnati Basin areas male white only, 1950 census, 1947–55 lung cancer deaths*—Continued

Traffic exposure miles/year	Nonsmokers			Pipe and cigar			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 60 plus; population, 12,078:																		
Surveyed	51	10	30.2	30	19	97.3	12	14	179.2	35	47	206.2	6	32	818.8	134	122 (30)	139.8
<12,000 miles	50	10	30.8	29	17	90.0	12	14	179.2	35	38	166.9	6	28	716.5	132	107	124.5
>12,000 miles	1	0		1	2		0	0		0	9		0	4		2	15	1,153.6
Age group, 40 plus; population, 31,665:																		
Surveyed	92	13	22.6	50	22	69.3	24	18	118.3	165	96	91.8	27	66	385.7	3,583	215 (55)	94.7
<12,000 miles	88	12	21.5	48	20	65.7	23	18	123.4	147	77	72.6	25	51	321.9	331	178	84.9
>12,000 miles	4	1		2	2		1	0		18	19	166.5	2	15	1,182.5	27	37	216.2

NOTE.—Numbers in parenthesis represent lung cancer deaths with incomplete history. Rates given are lung cancer deaths per year per 100,000 population at risk.

TABLE 3.—*Ohio rural areas—male white only, 1950 census—1947–55 lung cancer deaths*

Traffic exposure miles/year	Nonsmokers			Pipe and cigars			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 to 49; population, 24,787:																		
Surveyed	44	0		15	2		36	1		62	3	8.8	15	2		172	8 (11)	8.2
<12,000 miles	27	0		11	1		24	1		37	1		8	0		107	3	5.1
>12,000 miles	17	0		4	1		12	0		25	2		7	2		65	5	14.1
Age group, 50 to 59; population, 22,043:																		
Surveyed	46	0		28	0		35	1		35	6	75.5	13	4		157	11 (50)	30.7
<12,000 miles	35	0		18	0		23	1		22	4		7	3		105	8	33.5
>12,000 miles	11	0		10	0		12	0		13	2		6	1		52	3	25.4
Age group, 60 to 69; population, 18,890:																		
Surveyed	69	1		26	2		29	1		13	9	362.2	5	2		142	15 (79)	55.3
<12,000 miles	57	1		22	2		27	1		9	7		3	1		118	12	52.0
>12,000 miles	12	0		4	0		2	0		4	2		2	1		24	3	65.4
Age group, 70 plus; population, 16,060:																		
Surveyed	49	5		20	3		11	1		8	5	197.9	0	1		88	15 (63)	54.0
<12,000 miles	47	4		17	3		11	1		7	5		0	1		82	14	
>12,000 miles	2	1		3	0		0	0		1	0		0	0		6	1	
Age group, 40 to 59; population, 46,830:																		
Surveyed	90	0		43	2		71	2		97	9	30.5	28	6	70.4	329	19 (61)	19.0
<12,000 miles	62	0		29	1		7	2		59	5	27.9	15	3	65.7	212	11	17.1
>12,000 miles	28	0		14	1		24	0		38	4	34.5	13	3	75.8	117	8	22.5

See footnote at end of table

TABLE 3.—*Ohio rural areas—male white only, 1950 census—1947–55 lung cancer deaths*—Continued

Traffic exposure miles/year	Nonsmokers			Pipe and cigar			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 60 plus; population, 34,950:																		
Surveyed	118	6	21.3	46	5	45.6	40	2	.....	21	14	279.2	5	3	251.5	230	30 (142)	54.7
<12,000 miles	104	5	.....	39	5	.....	38	2	.....	16	12	.....	3	2	.....	200	26	54.7
>12,000 miles	14	1	.....	7	0	.....	2	0	.....	5	2	.....	2	1	.....	30	4	55.9
Age group, 40 plus; population, 81,780:																		
Surveyed	208	6	11.3	89	7	30.8	111	4	14.1	118	23	76.1	33	9	104.3	559	49 (203)	34.2
<12,000 miles	166	5	11.8	68	6	.....	85	4	.....	75	17	87.6	18	5	108.6	412	37	34.2
>12,000 miles	42	1	.....	21	1	.....	26	0	.....	43	6	54.5	15	4	104.2	147	12	31.9

NOTE.—Numbers in parentheses indicate cases with incomplete history. Rates given are lung cancer deaths per year per 100,000 population at risk.

TABLE 4.—*Cincinnati clean suburban areas, female white only, 1950 census, 1947–55 lung cancer deaths*

Traffic exposure, miles per year	Nonsmokers			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 to 49; population, 14,104: Surveyed	125	6	9.7	66	0	.....	39	2	.....	0	1	.....	230	9(1)	7.9
<12,000 miles	123	6	.....	66	0	.....	38	2	.....	0	1	.....	227	9	.....
>12,000 miles	2	0	.....	0	0	.....	1	0	.....	0	0	.....	3	0	.....
Age group, 50 to 59; population, 12,790: Surveyed	133	3	3.6	30	0	.....	21	2	.....	0	0	.....	184	5(0)	4.3
<12,000 miles	129	3	.....	30	0	.....	21	2	.....	0	0	.....	180	5	.....
>12,000 miles	4	0	.....	0	0	.....	0	0	.....	0	0	.....	4	0	.....
Age group, 60 to 69; population, 9,068: Surveyed	92	6	11.3	6	3	.....	0	0	.....	0	0	.....	98	9(4)	15.9
<12,000 miles	92	6	.....	6	3	.....	0	0	.....	0	0	.....	98	9	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 70 plus; population, 6,698: Surveyed	71	9	22.8	3	0	.....	1	0	.....	0	0	.....	75	9(4)	21.6
<12,000 miles	71	9	.....	2	0	.....	1	0	.....	0	0	.....	74	9	.....
>12,000 miles	0	0	.....	1	0	.....	0	0	.....	0	0	.....	1	0	.....
Age group, 40 to 59; population, 26,894: Surveyed	258	9	6.4	96	0	.....	60	4	12.2	0	1	.....	414	14(1)	6.2
<12,000 miles	252	9	.....	96	0	.....	59	4	.....	0	1	.....	407	14	.....
>12,000 miles	6	0	.....	0	0	.....	1	0	.....	0	0	.....	7	0	.....
Age group, 60 plus; population, 15,766: Surveyed	163	15	16.1	9	3	.....	1	0	.....	0	0	.....	173	18(8)	18.3
<12,000 miles	163	15	.....	8	3	.....	1	0	.....	0	0	.....	172	18	.....
>12,000 miles	0	0	.....	1	0	.....	0	0	.....	0	0	.....	1	0	.....
Age group, 40 plus; population, 42,660: Surveyed	421	24	11.1	105	3	6.6	61	4	12.8	0	1	.....	587	32(9)	10.6
<12,000 miles	415	24	.....	104	3	.....	60	4	.....	0	1	.....	579	32	.....
>12,000 miles	6	0	.....	1	0	.....	1	0	.....	0	0	.....	8	0	.....

TABLE 5.—*Cincinnati basin areas, white female only, 1950 census, 1947–55 lung cancer deaths*

Traffic exposure, miles per year	Nonsmokers			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 40 to 49; population, 10,492:															
Surveyed	57	1	.....	25	0	.....	40	0	.....	2	2	.....	124	3(1)	4.2
<12,000 miles	57	1	.....	25	0	.....	40	0	.....	2	2	.....	124	3	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 50 to 59; population, 9,079:															
Surveyed	69	3	13.2	19	0	.....	36	1	.....	1	0	.....	125	4(4)	9.8
<12,000 miles	69	3	.....	19	0	.....	36	1	.....	1	0	.....	125	4	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 60 to 69; population, 7,512:															
Surveyed	68	8	20.4	8	0	.....	7	2	.....	1	0	.....	84	10(4)	20.7
<12,000 miles	68	8	.....	8	0	.....	7	2	.....	1	0	.....	84	10	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 70 plus; population, 5,878:															
Surveyed	77	9	19.4	8	0	.....	3	0	.....	0	0	.....	88	9(0)	17.0
<12,000 miles	77	9	.....	8	0	.....	3	0	.....	0	0	.....	88	9	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 40 to 59; population, 19,571:															
Surveyed	126	4	7.7	44	0	.....	76	1	.....	3	2	.....	249	7(5)	6.8
<12,000 miles	126	4	.....	44	0	.....	76	1	.....	3	2	.....	249	7	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 60 plus; population, 13,390:															
Surveyed	145	17	20.3	16	0	.....	10	2	.....	1	0	.....	172	19(4)	19.1
<12,000 miles	145	17	.....	16	0	.....	10	2	.....	1	0	.....	172	19	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 40 plus; population, 32,961:															
Surveyed	271	21	48.8	60	0	.....	86	3	.....	4	2	.....	421	26(9)	11.8
<12,000 miles	271	21	.....	60	0	.....	86	3	.....	4	2	.....	421	26	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....

TABLE 6.—*Ohio rural areas—White female only, 1950 Cenusu 1947–55, lung cancer deaths*

TABLE 6.—*Ohio rural areas—White female only, 1950 Cenusu 1947–55, lung cancer deaths*

Traffic exposure, miles per year	Nonsmokers			Cigarette, light			Cigarette, moderate			Cigarette, heavy			Total, all classes		
	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate	Living	Cancer deaths	Rate
Age group, 46 to 49; population, 23,882:															
Surveyed	146	0	.....	40	0	.....	24	1	.....	4	0	.....	214	1 (8)	4.2
<12,000 miles	144	0	.....	39	0	.....	22	1	.....	4	0	.....	209	1	.....
>12,000 miles	2	0	.....	1	0	.....	2	0	.....	0	0	.....	5	0	.....
Age group, 50 to 59; population, 22,163:															
Surveyed	132	3	10.9	19	0	.....	9	0	.....	0	0	.....	160	3 (15)	9.0
<12,000 miles	128	3	.....	18	0	.....	9	0	.....	0	0	.....	155	3	.....
>12,000 miles	4	0	.....	1	0	.....	0	0	.....	0	0	.....	5	0	.....
Age group, 60 to 69; population, 19,046:															
Surveyed	152	5	16.5	9	0	.....	4	0	.....	0	0	.....	165	5 (21)	15.2
<12,000 miles	149	5	.....	9	0	.....	4	0	.....	0	0	.....	162	5	.....
>12,000 miles	3	0	.....	0	0	.....	0	0	.....	0	0	.....	3	0	.....
Age group, 70 plus; population, 16,580:															
Surveyed	83	12	41.2	1	0	.....	1	0	.....	0	0	.....	85	12 (48)	40.2
<12,000 miles	83	12	.....	1	0	.....	1	0	.....	0	0	.....	85	12	.....
>12,000 miles	0	0	.....	0	0	.....	0	0	.....	0	0	.....	0	0	.....
Age group, 40 to 59; population, 56,045:															
Surveyed	278	3	4.6	59	0	.....	33	1	.....	4	0	.....	374	4 (23)	5.4
<12,000 miles	272	3	.....	57	0	.....	31	1	.....	4	0	.....	364	4	.....
>12,000 miles	6	0	.....	2	0	.....	2	0	.....	0	0	.....	10	0	.....
Age group, 60 plus; population, 35,626:															
Surveyed	235	17	28.5	10	0	.....	5	0	.....	0	0	.....	250	17 (69)	26.8
<12,000 miles	232	17	.....	10	0	.....	5	0	.....	0	0	.....	247	17	.....
>12,000 miles	3	0	.....	0	0	.....	0	0	.....	0	0	.....	3	0	.....
Age group, 40 plus; population, 91,671:															
Surveyed	513	20	15.9	69	0	.....	38	1	.....	4	0	.....	624	21 (92)	13.7
<12,000 miles	504	20	.....	67	0	.....	36	1	.....	4	0	.....	611	21	.....
>12,000 miles	9	0	.....	2	0	.....	2	0	.....	0	0	.....	13	0	.....

TABLE 7.—*Significance tests on observed rate differences*

Group	Cincinnati basin areas				Cincinnati suburban areas			
	Traffic mileage		X^2 Tests	Difference SE difference	Traffic mileage		X^2 Tests	Difference SE difference
	<12,000	>12,000			<12,000	>12,000		
40 to 49 years:								
Cigarettes, moderate	11.7	33.9	2.7	1.2	10.1	36.6	3.5	1.5
All classes	26.7	79.4	7.2	2.0	14.6	31.4	2.4	1.4
50 to 59 years:								
Cigarettes, moderate	123.8	280.5	4.0	1.7	82.0	146.3	2.4	1.4
All classes	92.3	249.3	11.7	2.7	62.3	176.7	15.4	2.7
60 to 69 years:								
Cigarettes, moderate					181.7	545.5	8.4	2.3
All classes	119.5	851.7	46.1	3.2	112.3	251.7	9.0	2.6
40 to 59 years:								
Cigarettes, moderate	56.1	89.6	1.8	1.3	40.1	79.0	6.3	1.9
Cigarettes, heavy	194.5	888.2	3.5	3.0				
All classes	57.9	141.9	8.3	3.1	38.1	91.7	13.9	4.6
60 years and over:								
Cigarettes, moderate					203.0	400.0	4.3	2.0
All classes	124.5	1,153.6	89.6	4.1	141.5	201.3	2.4	1.6
40 years and over:								
Nonsmokers					30.1	44.9	.5	.2
Cigarettes, light					59.8	128.5	2.9	1.2
Cigarettes, moderate	72.6	166.5	7.8	2.7	65.9	127.6	7.9	2.6
Cigarettes, heavy	321.9	1,182.5	20.9	3.3				
All classes	84.9	216.2	27.6	4.1	78.2	120.7	9.2	2.7

MISCELLANEOUS (ALL NONSMOKERS)

Group	Sex, race	Age	Traffic mileage	Rate	X^2 test	Difference SE difference
Cincinnati basin	White male	40+	<12,000	21.5	0.9	0.9
Cincinnati suburban	do	40+	<12,000	30.1		
Cincinnati basin	do	40+	<12,000	21.5	3.9	1.6
Rural	do	40+	<12,000	11.8		
Cincinnati basin	do	40+	<12,000	21.5	1.4	1.1
Do	White female	40+	<12,000	14.8		
Rural	White male	40+	<12,000	11.8	2.4	1.5
Do	White female	40+	<12,000	15.9		
Cincinnati suburban	do	40+	<12,000	11.1	2.3	1.1
Cincinnati basin	do	40+	<12,000	14.8		
Cincinnati suburban	do	40+	<12,000	11.1	6.0	2.0
Rural	do	40+	<12,000	15.9		
Cincinnati basin	do	40+	<12,000	14.8	.5	.3
Rural	do	40+	<12,000	15.9		

NOTE.—Rates quoted in table represent lung cancer deaths per year per 100,000 population at risk. Deaths and rate for the whole 9-year period were used in the significance test calculations.

Dr. MILLS. Exhibit B speaks for itself, but I may say in very brief summary that here for the first time exposure to motor exhaust fumes are shown to double or triple the lung cancer rates already heightened by tobacco smoking. Exposure to general urban air pollution in addition, brings a further doubling of the already high rates and indicates a health hazard of truly serious proportions for those people exposed to the combined air pollution damages. For nonsmoking members of the population living in clean air and little exposure to urban motor traffic fumes, lung cancer remains a disease of insignificant proportions and virtually the same in both sexes, but for the smoker living in polluted air and driving extensively in urban traffic the respiratory hazards pyramid in serious fashion.

When I say "serious fashion," I mean that we get up to rates where 1 percent of smoking men in the 50 to 60 year category are dying each

year. Take that for another 20 years, and you are in a situation that is producing very very serious worry over the earth.

While my Ohio survey covered by exhibit B provides definite and significant information along these lines, severe limitation of research funds so restricted its size as to give inadequate coverage to many of its more detailed points. There is urgent need for a large scale survey along this same pattern, covering three or more of the country's large urban centers and certainly including Los Angeles where motor exhaust fumes constitute so large a part of the total air pollution problem. My Cincinnati survey must be considered more as a pilot survey, but it is highly significant that even this pilot investigation should expose such significant relationships.

As my final emphasis on the seriousness of polluted air for man, I would offer exhibit C.

Mr. ROOSEVELT. Exhibit C will be accepted by the committee, without objection.

(Exhibit C is as follows:)

EXHIBIT C

ON THE ORIGIN OF CANCER CELLS [1]

By Otto Warburg

Our principal experimental object for the measurement of the metabolism of cancer cells is today no longer the tumor but the ascites cancer cells (1) living free in the abdominal cavity, which are almost pure cultures of cancer cells with which one can work quantitatively as in chemical analysis. Formerly, it could be said of tumors, with their varying cancer cell content, that they ferment more strongly the more cancer cells they contain, but today we can determine the absolute fermentation values of the cancer cells and find such high values that we come very close to the fermentation values of wildly proliferating Torula yeasts.

What was formerly and

What was formerly only qualitative has now become quantitative. What was formerly only probable has now become certain. The era in which the fermentation of the cancer cells or its importance could be disputed is over, and no one today can doubt that we understand the origin of cancer cells if we know how their large fermentation originates, or, to express it more fully, if we know how the damaged respiration and the excessive fermentation of the cancer cells originate.

ENERGY OF RESPIRATION AND FERMENTATION

We now understand the chemical mechanism of respiration and fermentation almost completely, but we do not need this knowledge for what follows, since energy alone will be the center of our considerations. We need to know no more of respiration and fermentation here than that they are energy-producing reactions and that they synthesize the energy-rich adenosine triphosphate, through which the energy of respiration and fermentation is then made available for life. Since it is known how much adenosine triphosphate can be synthesized by respiration and how much by fermentation, we can write immediately the potential, biologically utilizable energy production of any cells if we have measured their respiration and fermentation.

The cancer cells can obtain approximately the same amount of energy from fermentation as from respiration, whereas the normal body cells obtain much more energy from respiration than from fermentation. For example, the liver and kidney of an adult animal obtain about 100 times as much energy from respiration as from fermentation.

I shall not consider aerobic fermentation, which is a result of the interaction of respiration and fermentation, because aerobic fermentation is too liable and

[1] The paper, including full text and references, may be secured from the National Cancer Institute.

too dependent on external conditions. Of importance for the considerations that follow are only the two stable independent metabolic processes, respiration and anaeribic fermentation-respiration, which is measured by the oxygen consumption of cells that are saturated with oxygen, and fermentation, which is measured by the formation of lactic acid in the absence of oxygen.

Since the respiration of all cancer cells is damaged, our first question is, How can the respiration of body cells be injured? Of this damage to respiration, it can be said at the outset that it must be irreversible, since the respiration of cancer cells never returns to normal. Second, the injury to respiration must not be so great that the cells are killed, for then no cancer cells could result. If respiration is damaged when it forms too little adenosine triphosphate, it may be either that the oxygen consumption has been decreased or that, with undiminished oxygen consumption, the coupling between respiration and the formation of adenosine triphosphate has been broken, as was first pointed out by Feodor Lynen (2).

One method for the destruction of the respiration of body cells is removal of oxygen. If, for example, embryonal tissue is exposed to an oxygen deficiency for some hours and then is placed in oxygen again, 50 percent or more of the respiration is usually destroyed. The course of this destruction of respiration is lack of energy. As a matter of fact, the cells need their respiratory energy to preserve their structure, and if respiration is inhibited, both structure and respiration disappear.

Another method for destroying respiration is to use respiratory poisons. From the standpoint of energy, this method comes to the same result as the first method. No matter whether oxygen is withdrawn from the cell or whether the oxygen is prevented from reaching by a poison, the result is the same in both cases, namely: impairment of respiration from lack of energy.

I may mention a few respiratory poisons. A strong, specific respiratory poison is arsenious acid, which, as every clinician knows, may produce cancer. Hydrogen sulfide and many of its derivatives are also strong, specific respiratory poisons. We know today that certain hydrogen sulfide derivates, thiourea and thioacetamide, with which citrus fruit juices have been preserved in recent times, induce cancer of the liver and gallbladder in rats.

Urethane is a nonspecific respiratory poison. It inhibits respiration as a chemically indifferent narcotic, since it displaces metabolites from cell structures. In recent years it has been recognized that subnarcotic doses of urethane cause lung cancer in mice in 100 percent of treatments. Urethane is particularly suitable as a carcinogen, because, in contrast to alcohol, it is not itself burned up on the respiring surfaces and, unlike ether or chloroform, it does not cytolyze the cells. Any narcotic that has these properties may cause cancer upon chronic administration in small doses.

The first notable experimental induction of cancer by oxygen deficiency was described by Goldblatt and Cameron (3), who exposed heart fibroblasts in tissue culture to intermittent oxygen deficiency for long periods and finally obtained transplantable cancer cells, whereas in the control cultures that were maintained without oxygen deficiency, no cancer cells resulted. Clinical experiences along these lines are innumerable: the production of cancer by intermittent irritation of the outer skin and of the mucosa of internal organs, by the plunging of excretory ducts of glands, by cirrhoses of tissues, and so forth. In all these cases, the intermittent irritations lead to intermittent circulatory disturbances. Probably chronic intermittent oxygen deficiency plays a greater role in the formation of cancer in the body than does the chronic administration of respiratory poisons.

Any respiratory injury due to lack of energy, however, whether it is produced by oxygen deficiency or by respiratory poisons, must be cumulative, since it is irreversible. Frequent small doses of respiratory poisons are therefore more dangerous than a single large dose, where there is always the chance that the cells will be killed rather than that they will become carcinogenic.

GRANA

If an injury of respiration is to produce cancer, this injury must, as already mentioned, be irreversible. We understand by this not only that the inhibition of respiration remains after removal of the respiratory poison but, even more, that the inhibition of respiration also continues through all the following cell divisions, for measurements of metabolism in transplanted tumors have shown that cancer cells cannot regain normal respiration, even in the course of many decades, once they have lost it.

This original mysterious phenomenon has been explained by a discovery that comes from the early years of cell physiology (4). When liver cells were cytolyzed by infusion of water and the cytolyzate was centrifuged, it was found that the greater part of the respiration sank to the bottom with the cell grana. It was also shown that the respiration of the centrifuged grana was inhibited by narcotics at concentrations affecting cell structures, from which it was concluded—already in 1914—that the respiring grana are not insoluble cell particles but autonomous organisms, a result that has been extended in recent years by the English botanist, Darlington, (5) and particularly by Mark Woods and H. G. du Bay (6) of the National Cancer Institute in Bethesda, Md. Woods and du Bay have experimentally expanded our concepts concerning the self-perpetuating nature of mitochondrial elements (grana) and have demonstrated the heredity role of extranuclear aberrant forms of these in the causation of neoplasia. The autonomy of the respiring grana, both biochemically and genetically can hardly be doubled today.

If the principle Omne granum e grano is valid for the respiring grana, we understand why the respiration connected with the grana remains damaged when it has once been damaged; it is for the same reason that properties linked with genes remain damaged when the genes have been damaged.

Furthermore, the connection of respiration with the grana (7) also explains a carcinogenesis that I have not mentioned previously, the carcinogenesis by X-ray. Rajewsky and Pauly have recently shown that the respiration linked with the grana can be destroyed with strong doses of X-rays, while the small part of the respiration that takes place in the fluid protoplasm can be inhibited very little by irradiation. Carcinogenesis by X-ray is obviously nothing else than a destruction of respiration by elimination of the respiring grana.

It should also be mentioned here that grana, as Graffi has shown (8), fluoresce brightly if carcinogenic hydrocarbons are brought into their surroundings, because the grana accumulate the carcinogenic substances. Probably this accumulation is the explanation for the fact that carcinogenic hydrocarbons, although almost insoluble in water, can inhibit respiration and therefore have a carcinogenic effect.

INCREASE OF FERMENTATION

When the respiration of body cells has been irreversibly damaged, cancer cells by no means immediately result. For cancer formation there is necessary not only an irreversible damaging of the respiration but also an increase in the fermentation, indeed, such an increase of the fermentation that the failure of respiration is compensated for energetically. But how does this increase of fermentation come about?

The most important fact in this field is that there is no physical or chemical agent which the fermentation of cells in the body can be increased directly; for increasing fermentation, a long time and many cell divisions are always necessary. The temporal course of this increase of fermentation in carcinogenesis has been measured in many interesting works, among which I should like to make special mention of those of Dean Burk (9).

Burk first cut out part of the liver of healthy rats and investigated the metabolism of the liver cells in the course of the ensuing regeneration, in which, as is well known, the liver grows more rapidly than a rapidly growing tumor. No increase of fermentation was found. Burk then fed rats for 200 days on butter yellow, whereupon liver carcinomas were produced, and he found that the fermentation slowly increased in the course of 200 days toward values characteristic of tumors.

The mysterious latency period of the production of cancer is, therefore, nothing more than the time in which the fermentation increases after damaging of the respiration. This time differs in various animals; it is especially long in man and here often amounts to several decades, as can be determined in the cases in which the time of the respiratory damage is known—for example, in arsenic cancer and irradiation cancer.

The driving force of the increase of fermentation, however, is the energy deficiency under which the cells operate after destruction of their respiration, which forces the cells to replace the irretrievably lost respiration energy in some way. They are able to do this by a selective process that makes use of the fermentation of the normal body cells. The more weakly fermenting body cells perish, but the more strongly fermenting ones remain alive, and this selective process continues until the respiratory failure is compensated for energetically

by the increase in fermentation. Only then has a cancer cell resulted from the normal body cell.

Now we understand why the increase in fermentation takes such a long time and why it is possible only with the help of many cell divisions. We also understand why the latency period is different in rats and in man. Since the average fermentation of normal rat cells is much greater than the average fermentation of normal human cells, the selective process begins at a higher fermentation level in the rat and, hence, is completed more quickly than it is in man.

It follows from this that there would be no cancers if there were no fermentation of normal body cells, and hence we should like to know, naturally, from where the fermentation of the normal body cells stems and what its significance is in the body. Since, as Burk has shown, the fermentation remains almost zero in the refrigerating liver growth, we must conclude that the fermentation of the body cells has nothing to do with normal growth. On the other hand, we have found that the fermentation of the body cells is the greatest in the very earliest stages of embryonal development and that it then decreases gradually in the course of embryonal development. Under these conditions, it is obvious—since ontogeny is the repetition of phylegeny—that the fermentation of body cells is the inheritance of undifferentiated ancestors that have lived in the past at the expense of fermentation energy.

STRUCTURE AND ENERGY

But why—and this is our last question—are the body cells dedifferentiated when their respiration energy is replaced by fermentation energy? At first, one would think that it is immaterial to the cells whether they obtain their energy from respiration or from fermentation, since the energy in both reactions is transformed into the energy of adenosine triphosphate, and yet adenosine triphosphate equals adenosine triphosphate. This equation is certainly correct chemically and energetically, but it is incorrect morphologically, because although respiration takes place for the most part in the structure of the grana, the fermentation enzymes are found for a greater part in the fluid protoplasm. The adenosine triphosphate synthesized by respiration therefore involves more structure than the adenosine triphosphate synthesized by fermenation. Thus, it is as if one reduced the same amount of sliver on a photographic plate by the same amount of light, but in one case with diffused light and in the other with patterned. In the first case, a diffuse blackening appears on the plate, but in the second case, a picture appears; however, the same thing happens chemically and energetically in both cases. Just as the one type of light energy involves more structure than the other type, the adenosine triphosphate energy involves more structure when it is formed by respiration than it does when it is formed by fermentation.

In any event, it is one of the fundamental facts of present-day biochemistry that adenosine triphosphate can be synthesized in homogenous solutions with crystallized fermentation enzymes, whereas so far no one has succeeded in synthesizing adenosine triphosphate in homogenous solutions with dissolved respiratory enzymes, and the structure always goes with oxidative phosphorylation.

Moreover, it was known for a long time before the advent of crystallized fermentation enzymes and oxidative phosphorylation that fermentation—the energy-supplying reaction of the lower organisms—is morphologically inferior to respiration. Not even yeast, which is one of the lowest forms of life, can maintain its structure permanently by fermentation alone; it degenerates to bizarre forms. However, as Pasteur showed, it is rejuvenated in a wonderful manner it it comes in contact with oxygen for a short time. "I should not be surprised," Pasteur said in 1876 (10) in the description of these experiments, "if there should arise in the mind of an attentive hearer a presentiment about the causes of those great mysteries of life which we conceal under the words youth and age of cells." Today, after 80 years, the explanation is as follows: "The firmer connection of respiration with structure and the looser connection of fermentation with structure.

This, therefore, is the physicochemical explanation of the dedifferentiation of cancer cells. If the structure of yeast cannot be maintained by fermentation alone, one need not wonder that highly differentiated body cells lose their differentiation upon continuous replacement of their respiration with fermentation.

I would like at this point to draw attention to a consequence of practical importance. When one irradiates a tissue that contains cancer cells as well as

normal cells, the respiration of the cancer cells, already too small, will decline further. If the respiration falls below a certain minimum that the cells need unconditionally, despite their increased fermentation, they die; whereas the normal cells, where respiration may be harmed by the same amount, will survive because, with a greater initial respiration, they will still possess a higher residual respiration after irradiation. This explains the selective killing action of X-rays on cancer cells. But still further: The descendants of the surviving normal cells may in the course of the latent period compensate the respiration decrease by fermentation increase and, thence, become cancer cells. Thus it happens that radiation which kills cancer cells can also at the same time produce cancer. Both events take place from harming respiration: The killing, by harming an already harmed respiration; the carcinogenesis by the harming of a not yet harmed respiration.

MAINTENANCE ENERGY

When dedifferentiation of the body cells has occurred and cancer cells have thereby developed, there appears a phenomenon to which our attention has been called by the special living conditions of the ascites cancer cells. In extensively progressed ascites cancer of the mouse the abdominal cavity contains so many cancer cells that the latter cannot utilize their full capacity to respire and ferment because of the lack of oxygen and sugar. Nevertheless the cancer cells remain alive in the abdominal cavity, as the result of transplantation proves.

Recently we have confirmed this result by direct experiments in which we placed varying amounts of energy at the disposal of the ascites outside the body, in vitro, and then transplanted it. This investigation showed that all cancer cells were killed when no energy at all was supplied for 24 hours at 38° C., but that one-fifth of the growth energy was sufficient to preserve the transplantability of the ascites. This result can also be expressed by saying that cancer cells require much less energy to keep them alive than they do for growth. In this they resemble other lower cells, such as yeast cells, which remain alive for a long time in densely packed packets, almost without respiration and fermentation.

SLEEPING CANCER CELLS

Since the increase in fermentation in the development of cancer cells takes place gradually, there must be a transitional phase between normal body cells and fully formed cancer cells. Thus, for example, when fermentation has become so great that dedifferentiation has commenced, but not so great that respiratory defect has been fully compensated for energetically by fermentation, we may have cells which, indeed, look like cancer cells, but are still energetically insufficient. Such cells, which are chemically not cancer cells, have lately been found not only in the prostate but also in the lungs, kidney, and stomach of elderly persons. Such cells have been referred to as "sleeping cancer cells" (11, 12).

The sleeping cancer cell will possibly play a role in chemotherapy. From energy considerations, I could think that sleeping cancer cells would be killed more readily than growing cancer cells in the body, and that the most suitable test objects for finding effective killing agents would be the sleeping cancer cells of skin; that is, precancerous skin.

SUMMARY

Cancer cells originate from normal body cells in two phases. The first phase is the irreversible injurying of respiration. Just as there are many remote cases of plague—heat, insects, rats—but only one common case, the plague bacillus, there are a great many remote causes of cancer—tar, rays, arsenic, pressure, urethane—but there is only one common cause into which all other causes of cancer merge, the irreversible injuring of respiration.

The irreversible injurying of respiration is followed, as the second phase of cancer formation, by a long struggle for existence by the injured cells to maintain their structure, in which a part of the cells perish from lack of energy, while another part succeed in replacing the irretrievably last respiration energy by fermentation energy. Because of the morphological inferiority of fermentation energy, the highly differentiated body cells are converted by this into undifferentiated cells that grow wildly—the cancer cells.

To the thousands of quantitative experiments on which these results are based, I should like to add as a further argument the fact that there is no alternative today. If the explanation of a vital process is its reduction to physics and chemistry, there is today no other explanation for the origin of cancer cells, either

special or general. From this point of view, mutation and carciongenic agent are not alternatives, but empty words, unless metabolically specified. Even more harmful in the struggle against cancer can be the continual discovery of miscellaneous cancer agents and cancer viruses, which, by obscuring the underlying phenomena, may hinder necessary preventive measures and thereby become responsible for cancer cases.

Dr. MILLS. I offer exhibit C which is an extract of a portion of a recent paper by Otto Warburg entitled, "On the Origin of the Cancer Cell," translated and published by members of the staff of the National Cancer Institute. Dr. Warburg has for 30 years been the world's leading authority on metabolic processes within the cell, and in this article he discusses the damage to enzymes and catalysts within the cell wrought by pollutants commonly found in urban air—ozone, nitrogen oxides, sulfur gases, several hydrocarbon compounds, and so forth. These pollutants may cause acute swelling and death of cells lining the air passages; but if the cell is damaged but does not die, then its enzymes and catalysts undergo internal changes always pushing farther along the road to becoming a cancer cell. In the human being it is considered that it takes between 10 and 20 years to accomplish that slow transformation to the cancer cell in the air passages. Isolated but repeated damaging episodes push such cells always nearer to the stage of real cancer—here is a point for real concern among populations subject to intermittent smog episodes, a few may die of acute damage in each episode but the many are also suffering hidden and cumulative damage.

It should be of interest here that those most interested in industrial health—the health of inplant workers—have recently reconsidered the longer term injurious possibilities of ozone and have dropped its maximal allowable limits for inplant workers from one part per million to one-tenth part per million. Further discussion on this point is carried in my exhibit A.

In closing, I would say that this problem of the health hazards of polluted air warrants all the attention and study that can be given to it in the months and years ahead. We are beginning to see the seriousness of the situation and the extent of a few of the health hazards, but to fill in the finer details of the picture will require much further work and money.

Mr. ROOSEVELT. Thank you, Dr. Mills. The facts and figures which you give are rather startling and frightening, I think, to anyone interested in the safety of the public health.

I have just a few general questions. No. 1, you have indicated here, I believe, to quote from your statement, that the Los Angeles situation is indeed so severe and so wrought with health hazards that any pollution-control program should be put on the compulsory health basis. That alone can provide it with necessary overriding authority. For the information and the assistance of the committee, have you any definite recommendations as to the best manner in which the Federal Government can concentrate its research facilities or its assistance to research facilities in order that the full significance of this program can be made available? In other words, should it be handled almost exclusively upon the recommendation of the local health authorities or the State health authorities, or can it best be handled by individual research units such as exist in UCLA and USC, making requests, or in other words, is it the responsibility of the local health authori-

ties to coordinate all of the existing facilities and provide a program which could then be acted upon?

Dr. MILLS. No, sir, I wouldn't say at all that the total responsibility lies on the local health or control authorities, because this problem is universal in industrial cities. It just happens that it is more acute and more further advanced in Los Angeles. But this survey of mine, for instance, showing the relationship of motor-exhaust fumes to lung cancer was made in Cincinnati, one of our smaller midwestern industrial cities, that has much more natural ventilation than you have here.

Los Angeles is on the spot more than any other place and is suffering more. It provides a very, very valuable biological laboratory for investigation of this problem, more so than any other single region, but the findings will be applicable all over the world. I shouldn't limit it to this country. London is very much concerned indeed and many other cities of the world that have industrialized and undergone a tremendous expansion in their combustion-power developments. I say "combustion-power developments" because the crux of the problem lies essentially and to a great extent in the output from power-developing equipment that is developing that power on a combustion basis.

With us it used to be a soft coal as the major fuel, so we in Chicago and Cincinnati had black smoke. Well, we corrected that. Now, we find that the increasing use of power on a combustion basis, which is spreading more in the mobile-motor field than anywhere else, is bringing a new type of problem. It is the same problem, just a new type. So that's why I made that reference to its relation universally over the earth.

Mr. ROOSEVELT. In other words, then because probably we don't have much authority to go beyond the national scope of the problem, you feel that perhaps Congress should direct the Department of Health, Education, and Welfare through the Public Health Service and the Surgeon General to undertake and to exercise a greater supervision of all of the sources which could be utilized to make these surveys and bring these facts into an up-to-date condition?

Dr. MILLS. Yes, indeed I do. I think that all along the line a clear realization that there is a health hazard involved of a very considerable stature will be the first step necessary in getting, in providing the impetus to a more serious attack on the problem along the lines of control and prevention.

I think the Federal Government itself through its Department of Health, Education, and Welfare with the Public Health Service has a very direct and pertinent part to play in the program. For instance, the pilot survey that I carried out needs expansion and in various cities. Well, that comes into a field of activity that is also prohibitive to local groups. It isn't completely impossible. I would much prefer to see it done by groups locally in each city, but it becomes an immense undertaking.

Mr. ROOSEVELT. Also isn't there some danger that it will be done following various different standards and therefore not have a universal application?

Dr. MILLS. That is an added danger. The greater the base, that is, including several cities that we can have on a comparable plan of study, the more value will come out of the study.

For instance, I think that a Los Angeles survey—I am not just sure you could separate as I did—yes; you could—separate air pollution in general from that that is added to for the heavy driver. But that could be done perfectly well. You have plenty of people who live in the center of Los Angeles to make a very good control group and you have people who live out in—am I wrong? Are there any clean areas left in the county?

Mr. ROOSEVELT. Quite a ways out in the county.

Dr. MILLS. Remember, we want people who have been there for more than 10 years. That further handicaps the survey, you see.

Mr. ROOSEVELT. You might have to go as far as Oklahoma to find that.

Dr. MILLS. I think the areas could be found out Santa Monica way, or along the gulf or along the ocean, safely away from the oil refineries, perhaps, if they are still spilling.

But there are other ways. There are other avenues of study also that need followup, this matter of the chronic damage in the air passages. We are not so concerned with the acute episodes. We hope we can get pollution down below those levels and keep it there, but it has always seemed to me very risky for Los Angeles to be dallying with a potential ozone concentration of one part per million for very many hours. As their smog alert system indicates, they are ready to move out at one and a half—well, if they can still move.

There are other avenues. This matter of the—we need more information on these changes within the cell from these air pollutants which act specifically to interrupt intracellular processes, enzymatic and catalytic, which are the basis of life within the cell, and the interruption that they bring is never recovered from within that cell. Perhaps it would be better if that cell just died—just so enough of them don't die that the whole individual dies. But those that are damaged and don't die never return to a normal base completely, especially so far as lung cancer is concerned, and it is beginning to look as though they don't return in other ways, too. There is a growing worry in medical circles also about the chronic forms of lung damage that lead to impaired function but don't kill; they just make the individual less of a functional unit.

Mr. ROOSEVELT. Would it be correct to say then that this requires a three-prong attack: One, have more scientific knowledge as to the actual effects of air pollution upon individual human beings; two, that that information should be available to public bodies in order that they can correctly assess the danger point or the danger points, more correctly assess them upon individual human beings, and therefore they can judge whether the efficiency of control units at this point or that point really does any good; in other words, to put into effect a control system which doesn't really contribute to the safety of human life—and I don't mean just death by that, I mean even the crippling of human life—is not going to do much good; therefore, we must know at what point we really are helping the health picture of the community; and third, that simultaneously with this must go forward the development of the machinery itself?

Dr. MILLS. That is right, sir.

Mr. ROOSEVELT. One of the major problems in this picture, because Federal funds are naturally very limited, they are going to have to be matched, in my opinion, by State funds, which up to this time have been considerably restricted, you might say, as well as by local funds and every other source from which they may be had. I think the division of these funds on these three fronts is going to be a very difficult problem. In other words, should we give 75 percent of the available funds to the development of the devices and 25 percent to such work as you have been describing, or should we put it on a 50–50 basis, or have you any suggestions as to how we might be guided in our suggestions?

Dr. MILLS. No; I have no specific suggestion there as to a percentage division of funds. That would require a correlated study that I don't have the information available to me to make it. I don't think it is my place to make it. I strongly suspect that Los Angeles would be delighted if the Federal Government matched what they are spending on this air-pollution problem in the way of health and particularly control devices, knowledge of the situation and control. They, of course, are spending probably more than all the rest of the country put together, so that for a countrywide basis if you were matching, the rest of the country wouldn't get much yet, which might possibly be wise because, as I said, this is the ideal laboratory and more progress has been made on analyzing this situation than in any other urban community.

I may say from the statistical evidence on deaths here in Los Angeles in association with smog episodes, we find that the respiratory and cardiac deaths begin to rise when the total oxygen, as Professor Haagen-Smit measures—and this is correlated on his figures—exceeds two-tenths part per million.

Mr. ROOSEVELT. That is the death?

Dr. MILLS. That is the death. Now, we would hope to keep below that. In fact, in industrial hygiene circles today they are advocating that one part—I mean one-tenth part per million be the limits. Well, here deaths begin to show up above two-tenths part of a million. So since you have here in Los Angeles gone up to one part per million, from the health standpoint we are inclined to recommend that the aim here be for now and all future incoming—whether they are fixed or mobile combustion plants—be a 90-percent across-the-board reduction of all pollution sources from what they are at present.

Now, that is a very serious situation. I have talked it over with Mr. Griswold. I don't think it is impossible at all. I do think it is going to be necessary if a decent living situation is to be recovered here, and the sooner it is put into effect the better.

Mr. ROOSEVELT. One last question, Dr. Mills: Would you feel that it would be correct to say in your opinion from what you have seen of the problem that this could be classified as requiring emergency action?

Dr. MILLS. Well, I am inclined to think so, if the considered opinion as expressed yesterday had a minimum time of 3 years for any relief. That is a long while. Well, I am not living here. I wouldn't live here, you see, under any circumstances. Whom am I to object to it? Yes; I really think it is an emergency situation.

Mr. ROOSEVELT. Mr. Steed, do you have any questions?

Mr. STEED. Doctor, did your work here indicate to you that modern commercial air conditioners can filter this air so that it is all right?

Dr. MILLS. Well, it depends upon what you use.

Mr. STEED. The ordinary type home air conditioner that you would buy in a store, do they——

Dr. MILLS. No.

Mr. STEED. Do they filter properly?

Dr. MILLS. No. You would have to use either an activated charcoal filter, which is very cumbersome, or a mat-type electrostatic air filter, not the baffle type, but a mat where the air is drawn through an oil-paper mat, which itself carries a high-voltage charge. Those are not too expensive, but they are more expensive than afterburners. It would cost each homeowner by the time they are installed around $500, but by then pumping air in, closing the house up, you could have all the fresh air you want. Of course, you are not letting the nice California air in except through the filter.

Mr. ROOSEVELT. There is also an additional cost in the operation of it?

Dr. MILLS. Very little, very little.

Mr. ROOSEVELT. Very little?

Dr. MILLS. Yes; just maybe——

Mr. STEED. But the question that I was making is: People who think that they have protected themselves from danger to their lungs with air conditioners in the home are in your opinion not so protected?

Dr. MILLS. Well, the thing they do ordinarily is to close the structure up with today's usual commercial air conditioning. They just recirculate indoor air. Now, it is true that as you breathe this smoggy air in, none of the harmful ingredients come back out. They all stay in there, so you gradually purify your indoor air, you see.

Mr. ROOSEVELT. I hope I can keep the committee here until after lunch.

Mr. SHEEHAN. I think you need more population in Los Angeles.

Dr. MILLS. They are coming.

Mr. STEED. We know in many cases doctors have seen fit throughout the country to advise patients that their health required a change of climate. Now, this damage that you speak of here that results in this increase of deaths, as a doctor could you give a person here an examination and feel that you could determine enough to be justified in advising them to leave here in the interests of their health.

Dr. MILLS. Well, not unless he was fairly well along. It is difficult to get the early stages of the damage.

Mr. STEED. It is nothing then that would be easily discernible or discoverable?

Dr. MILLS. Not unless he is well along and if he is well along he isn't going to recover too much any place, you see, because it is an irreparable damage that comes.

Mr. STEED. Did your studies give you any opportunity to know about how long a person could remain exposed to air as you find it here before permanent damage would begin to become serious?

Dr. MILLS. No, no; my studies didn't carry any information on that point. It would be rather difficult to get. There, I think the trend in lung-cancer development could provide more significant information than the study of any other condition, and that has not been done adequately yet. I believe that it would be very pertinent for such a survey on lung cancer, particularly, to be carried out here.

Mr. STEED. Would you say that the person so afflicted, if they did change into a new location where the air was not contaminated, that their recovery would be justified in the sense that other changes of climate for health purposes are?

Dr. MILLS. No. You shouldn't have used the word "recovery." You will stop progress of the damage. Now, to what extent you would get recovery, we don't know in this particular situation. You would not recover—any of the hazard, for instance, any of the progress that has been made toward the development of cancer cells in your air passages, but you might stop it there, unless you were a smoker and took your smoking along with you. Then you would go on with the hazard, but so far as the air pollution goes, you could stop that factor, the progress toward severe ill health and death from that factor; yes.

Mr. STEED. That is all.

Mr. ROOSEVELT. Congressman Sheehan?

Mr. SHEEHAN. Doctor, in reviewing the hearings for the last day and a half now, one of the things that sticks in my mind is there seems to be a division of opinion among the people who have been around here and who I have talked to as to whether or not the city officials and the county officials have been doing a worthwhile job in living up to what they are supposed to do as public officials. Now, in the light of your 30 years' experience, and you say you did come here as a consultant to the county medical board, would you care to give an expression of your own opinion as to whether or not the city and county officials in Los Angeles have been doing a mediocre job, a poor job, a fair job or a good job in trying to combat this nuisance?

Dr. MILLS. You say "city officials." Are you referring to the city of Los Angeles?

Mr. SHEEHAN. By officials I would mean, let's say, all the subdivisions of the Government in both the city and county.

Dr. MILLS. Well, the only place the city officials within the county come into the picture is in the matter of solving the rubbish problem, the backyard incinerator problem.

Mr. SHEEHAN. Let's hold it then to the county officials who are the overall board.

Dr. MILLS. I would like to say before you get off of that, though, I do think the municipal officials have dragged their feet very consistently on that issue. I am very glad now to say that definite steps are being taken toward a municipal collection of the rubbish and its proper disposal, not incineration on the site of its immediate home collection.

Now, to come back then, we would then go to the air pollution control district. My first contact with that was back in 1950 and 1951 when I was sitting as a consultant with the State legislative interim committee on air pollution. Then I have been in close contact with it on these three visits, and it is my considered opinion as of now that the control district is doing a good job, that it having a definitely established health hazard connected with the problem that puts it on much firmer ground for enforcing the stringent control regulations and the installation of devices that are going to cost much more money still and getting free cooperation. If it isn't free, winning in court battles on that basis, as they have done.

I would say that they are doing a very good job and more power to them. Of course, you received yesterday word of the amount of money they have available. You appreciate by now that it really is a big

problem, an enormous problem. Their contribution has been very great. Perhaps they do not have enough funds. I sincerely believe that; that more funds for them to use could be and would be very well spent indeed on the control.

They are not engaged in the study of the health side of the problem and whether that is proper or not, that is not for me to say. But so far as the health side of the picture is concerned, there is no local support, practically no local support. Now, this is where local support is badly needed in some form, either by cooperation in work or by grants.

Mr. ROOSEVELT. Would, perhaps, a better understanding of the health problem bring more public support to the entire district locally for the enforcement bureau?

Dr. MILLS. I would hope so. I would sincerely hope so because it is—you might say I am sort of a rugged individualist. I like to see local communities solve their own problem so far as they can, and I think this community has done a remarkable job to the extent of their facilities. I would very much prefer to see a local setup, whether it be universities or an outgrowth from the medical association itself, that you would say are the guardians of the community's health; that funds be made available for them to study their own problem.

Now, that doesn't necessarily say that, for instance, this survey over the whole country in various municipalities shouldn't be carried by the Public Health Service. I think that is a very appropriate item of activity and expenditure, but just as pertinent, I think, is the allocation of funds. Now, I am an outsider. I have no way of knowing how much the local community would pour into such a setup if there were one available as a community entity under medical auspices, which might in a way act as adviser perhaps to the pollution control district, establish the limits for a community for each pollutant, say, or for the sum of them.

Mr. ROOSEVELT. Now, Dr. Mills, do you feel that if the local community—and I am now talking about, let's say, the board of supervisors—would make available larger sums for medical research and to establish the health problem, that that in itself might be of tremendous assistance again to the local authority, and then seeking additional funds for a more rapid solution to the machinery that we need to effect control?

Dr. MILLS. Yes. I would give it is my considered opinion that if the local community is going to put over 4 million—how much was it?

Mr. SHEEHAN. Four and a half.

Mr. ROOSEVELT. Four and a half million.

Dr. MILLS. In the coming year into control and prevention equipment, that they should at least put half of that much into health; maybe not quite that much but it does seem lopsided.

Mr. ROOSEVELT. In other words, $2 million or more could be usefully put to work in your opinion?

Dr. MILLS. Not the first year.

Mr. ROOSEVELT. But I mean on a program, $2 million stretched out over a period of time. It could be usefully put to work immediately?

Dr. MILLS. Oh, definitely, and to very good use.

Mr. STEED. Doctor, do you know any control device, effective device or action being taken in any other American city that is not being used in Los Angeles?

Dr. MILLS. Yes, sir.

Mr. STEED. Could you give us some examples?

Dr. MILLS. Well, rubbish collection. All right. They are getting close to finally being a grownup community here and collecting their rubbish. We, of course, all the larger municipalities in the East, are. That is just one of the necessary phases of a community's existence.

Mr. SHEEHAN. Right.

Dr. MILLS. Another, of course, is motor inspection, twice yearly motor inspection. We pay to have that done, not only in taxation, but we pay for each inspection and we are willing to do it because that is a check of our vehicle twice a year there. So far it is only for safety in the steering and lighting control mechanisms, but I anticipate that every soon that will also be on the combustion end of the motor vehicle.

Mr. ROOSEVELT. Congressman Sheehan.

Mr. SHEEHAN. Doctor, along the line of your philosophy of having the local community do it because they are most conscious of the problem, could we carry that a little further: Mr. Roosevelt has already expressed the idea that maybe the Federal Government ought to allocate some funds according to the laws that are already on the books. Would you agree with the thought then that the Federal Government's share or part in this program should be to allocate some funds to the local community, let them take the problem over and try and solve it and then the Federal Government could correlate all the known facts from the various communities rather than go in and handle the program themselves.

Dr. MILLS. With one exception, yes. That one exception would be in certain studies that gain their maximum importance and value from a uniformity in a number of cities. Now, that sort of study—well, it could be that they correlate. Maybe you are right there.

Mr. SHEEHAN. In other words, my thought is I don't like to see, like yourself, as a matter of philosophy, the Federal Government officials coming in here and running everything for the county of Los Angeles. If they just gave the funds and said, "We want to get specific information on a countrywide basis," then you people here who know the situation most closely could do it and give out also the other information which they can correlate in Washington rather than put the manpower in here.

Dr. MILLS. That is right. If they want other information than the Federal Department of Health, Education, and Welfare want, that is all right, but at least get the standard information that needs correlation across the country, yes.

Mr. SHEEHAN. It was our experience that the Federal Government—at least mine is and I think Mr. Roosevelt and Mr. Steed will bear me out—the minute you get into Washington you have red tape, you have forms, you have time waste, which Los Angeles can't wait for.

Dr. MILLS. That is right. They have a little of it here, but it doesn't compare.

Mr. SHEEHAN. With what we have?

Dr. MILLS. That is right.

Mr. ROOSEVELT. Dr. Mills, you would, however, agree probably in relation to the development of devices that in that particular field, because it comes from so many different quarters, that there would be

perhaps a more direct value in having something like the Bureau of Mines and Standards correlate the work directly in that?

Dr. MILLS. That would be a more valid and useful area of participation; yes. Although it isn't any more—perhaps I shouldn't put it that way—it is no more important than to do certain phases of the health work.

Mr. SHEEHAN. In due justice, Doctor, I should point out that Mr. Roosevelt this morning—he didn't accuse me—I don't want to use that word—of being a chamber of commerce man for the city of Chicago, but I do know yesterday that several people on that stand said that maybe the Federal Government and the rest of the country should share in the cost. But on the other hand, as was pointed out last year in Chicago and Cook County, we have 1 of the 7 mechanical wonders of the world in our Sanitary District plant. But we have spent all that money ourselves, the taxpayers of Chicago, and today they come in from all over the country and all over the world to find out the progress we have made and certainly maybe we just can't expect the Federal Government to do everything if the city does a part of it.

Dr. MILLS. Yes. As a philosopher I would certainly say that I would not want to see the Federal Government pay for the safety devices within a community itself.

Mr. SHEEHAN. Right.

Dr. MILLS. Those are the prices they should be willing to pay to make their own community a decent place to live.

Mr. SHEEHAN. And if some other area benefits by their research——

Dr. MILLS. We won't try to collect from that other area.

Mr. SHEEHAN. That is what I am trying to get at.

Mr. STEED. Doctor, would it be any comfort to the citizens here to know that this isn't the only bad thing in the world. If you think smog is the only bad thing in the world, come out and try one of our dust storms. You will find there are other problems, too.

Dr. MILLS. Yes, indeed; and just as serious a menace, more serious in some ways.

Mr. PRICHARD. Doctor, I would like to ask a couple of questions, if I may.

As I understood your testimony, your investigation has disclosed the fact that there was a greater incidence of lung cancer in those persons who were addicted, in some degree at least, to the smoking of tobacco.

Dr. MILLS. Yes, sir.

Mr. PRICHARD. Now, did you discover that that was caused by the fact that the cigar, or cigarette, or pipe, whatever it might be, acted as sort of a filter which precipiated the pollutant and made it toxic?

Dr. MILLS. The air pollutant?

Mr. PRICHARD. Well, as you draw on a cigarette, for example, you draw the air through the cigarette and the cigarette acts as a filter for the air and does that precipitate the pollutant out of the tobacco and thereby produce a toxic effect?

Dr. MILLS. There is no evidence to that end and we would have to consider immediately that, shall we say, 95 percent of the breath of the breathing is not done through the cigarette; it is done without the cigarette.

Mr. PRICHARD. Let me say this: I had this experience here a while back. A man whom I knew lighted up a pipe in the vicinity where

they were spraying orchard trees with cyanide of potassium and just one draught on his pipe nearly killed the man, because the inhalation of the air through the tobacco precipitated the cyanide of potassium inside of his pipe and nearly killed him. Now, does the same kind of thing occur with reference to pollutants?

Dr. MILLS. I would say there is no information on that question.

Mr. PRICHARD. Shouldn't there be an investigation of that subject to discover whether the inhalation or passage of air through the tobacco operates to precipitate the pollutants so as to make them toxic?

Mr. MILLS. Yes; that would be a logical step to take.

Mr. PRICHARD. There is one other thing that I wanted to ask you about and that is this in-plant allowance of pollutants in the air. Is that allowance, the maximal allowance of one-tenth of one part per million predicated upon the supposition that the person will be in plant for an 8-hour period?

Dr. MILLS. Well, those studies predicate—they are usually carried on the basis of between 5 and 7 hours of exposure, although they say an 8-hour day. But the experiments are usually predicated on not over 7 hours of exposure each day, because, after all, they are in the washroom part of the time getting ready to come in and out.

Mr. PRICHARD. You say, as I understood it, that the experience here in Los Angeles had been 10 times as great as that maximal allowance for in-plant, up to 1 part in a million.

Dr. MILLS. Yes.

Mr. PRICHARD. Is that for an 8-hour period or it that for one moment of time?

Dr. MILLS. No; that was the peak. That was a peak, not maintained. For that reason I have asked Dr. Haagen-Smit to supply me with the accumulated amount of total oxidant in the air for each day for me to correlate with deaths. You see, this effect of total oxidant—let's speak of that instead of ozone, although ozone is a major part of it—that injures but on a time base. It takes a very high concentration for, we will say, in half an hour to do injury, but it takes a lower concentration if exposed for an hour, still less if exposed for 4 hours. The dosage is concentration times time, you see, so I am very anxious to correlate the concentration times the duration daily against deaths. We may have even more significant and closer correlation there.

Mr. PRICHARD. The net result of what we just discussed then simply evidences the fact that there is very substantial areas within which study and survey should be made; is that it?

Dr. MILLS. Indeed, yes. That is the last, final paragraph of my paper. These studies so far have only been more or less a pilot or indicative of the steps to be taken, the directions to be followed.

Mr. PRICHARD. That is all.

Mr. ROOSEVELT. Mr. Biscailuz, do you have any questions?

Mr. BISCAILUZ. I believe everything has been sufficiently covered.

Mr. ROOSEVELT. Thank you, Dr. Mills, very much for your presence and the trouble you have taken to come here.

Mr. PRICHARD. Just a minute. The press wants to take a picture.

Mr. ROOSEVELT. The press wants to take a picture of you. You have become a celebrity, so do you mind sitting down for a minute?

Dr. MILLS. I picture so poorly.

Mr. ROOSEVELT. Thank you, Dr. Mills, very much.

Dr. MILLS. Thank you for your kindness.

Mr. ROOSEVELT. We certainly appreciate it.

The committee will hear from Dr. Kotin now.

Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. KOTIN. I do.

Mr. ROOSEVELT. Would you give your full name and address, please, to the reporter.

Dr. KOTIN. Dr. Paul Kotin, K-o-t-i-n. Is my business address good enough?

Mr. ROOSEVELT. Yes.

Dr. KOTIN. University of Southern California School of Medicine.

Mr. ROOSEVELT. Dr. Kotin, we are delighted to have you, sir, and we should be very happy to hear whatever information you would care to give the committee in relation to this problem which we are studying.

Mr. PRICHARD. Will you please first state your qualifications.

Mr. ROOSEVELT. As modestly as you want to.

TESTIMONY OF DR. PAUL KOTIN, UNIVERSITY OF SOUTHERN CALIFORNIA SCHOOL OF MEDICINE, LOS ANGELES, CALIF.

Dr. KOTIN. I am a teacher. I am associate professor of pathology of the medical school. I have been engaged in air pollution research for the past 5 years. Beyond that, I don't know that I have any qualifications.

Excuse my ignorance. I am pretty obtuse. What would substantially constitute the information you would want?

Mr. ROOSEVELT. Dr. Kotin, we are particularly anxious to establish your opinion as to the importance, the degree of emergency which you feel exists in relation to the public health aspects of the danger of smog to the county of Los Angeles, to the public that lives here, or to other areas, if you want to discuss other areas.

Mr. STEED. Let me ask the doctor a question. Perhaps it would help.

Dr. KOTIN. Yes.

Mr. STEED. In the research work that you have been doing, do you believe Los Angeles can get rid of smog?

Dr. KOTIN. I would have no idea. My work has been solely concerned with what Los Angeles can do, what the smog can do to people, but as far as any of the engineering aspects, control aspects, I am sure I know significantly less about it than perhaps anybody in this room.

Mr. STEED. Then your research has convinced you, I assume, that there is a serious problem?

Dr. KOTIN. Well, there is a problem. "Serious" is a relative term. We began our study, as I say, some 5 years ago in an attempt to see what the effects of atmospheric pollutants would be under rigidly controlled circumstances, specifically free of economic, political implications, and so on. These implications we felt could probably be more accurately assessed subsequent to the accumulation of data rather than assume that the biological work is going to be a reflection of the emotions associated with the problem.

We approached the research problem in a manner no different than any problem is approached, and quite obviously after some 5 years we have a few ideas, observations, and maybe a conclusion or two.

First of all, I think I might categorically state that, assuming we agree on the significance of the term "emergency" as manifested by a burning house requiring a fire engine to come down the street, a very undesirable state exists, exceedingly undesirable state exists, a state that has great potentials for evil unquestionably. But I would be less than honest if I felt there were an emergency, because if there were I would move out, taking my wife and children. All the tables, data in in the world do not negate the fact that I live in Los Angeles. I am not kept here by any legislative order, and I could leave if I wanted to, and I am not. I think that is perhaps as eloquent as anything else I might have to say from now on.

On the basis of our data, we feel that living in Los Angeles carries no greater likelihood of impending death than living in New York, Chicago, Washington, or Cincinnati.

Mr. PRICHARD. Would you include Chicago in there, please?

Dr. KOTIN. I did include Chicago. I spent the first two and a half decades of my life in Chicago, a city I dearly hold in my recollection.

Mr. SHEEHAN. Thank you for that last observation.

Dr. KOTIN. But seriously, air pollution is bad. How bad we just can't say, but I think we can say negatively that there is nobody dead now who would be alive with smog as the lethal agent.

Mr. ROOSEVELT. In other words, you do not agree with Dr. Mills's previous testimony?

Dr. KOTIN. Well, let's put it this way: I place different interpretations on the significance of data. I am sure his numbers are correct, but I am reminded of the cartoon in the Mirror—I guess it was yesterday or the day before—in which a young man came to his boss and said, "Not knowing which side of the question you are on, we prepared data so you can support either side," and I think the same applies to much of the statistical data here. The perimeters for a sound epidemiologic study in the Los Angeles area, as a scientist speaking only for myself, are not sufficiently well established. I don't think the rules, the limitations are sufficiently well documented to draw anything more than impressions from the data, and that is about as far as I would go with any of the epidemiologic data.

Mr. ROOSEVELT. You will have to translate that word, sir.

Dr. KOTIN. I mean looking at how many people lived on a given day—vital statistics would be a better word, I suppose.

Mr. ROOSEVELT. Thank you.

Dr. KOTIN. I do know on the basis of our experimental work in—since somebody is going to question this I will answer it now—certainly an animal is not a human being and there are limits to which you could—limitations you must place on animal data, but I don't think anybody in this room would refuse a shot of penicillin for a severe pneumonia. Yet certainly the efficacy of penicillin and antibiotics were first unquestionably established in the mouths of the guinea pig or the dog or whatever animal there happened to be, and by and large traditionally animal data with acceptable variations are relatively applicable to the human experience So that on the level of our own experimental data, I don't see how I can feel any differently when over the years we would expose animals to concentrations

of smog, synthetic smog, and again I will stipulate with all of the limitations that are associated with our synthetic reproduction of smog. But, as I say, over the years when you expose endless numbers of animals to concentrations that are anywhere from 10 to 50 times greater than we could even have remotely anticipated or ever have had, when you expose these animals for periods of time that are infinitely longer than the humans are exposed in Los Angeles, and you see a dog or a monkey some 70 weeks after being exposed to these things, all these artificial concentrations showing no permanent accumulated effect, you somehow begin to get the idea that this thing is a nuisance, it is bad, it should be gotten rid of, but as a potential lethal agent I as yet have seen no published data or obtained any data myself that would give me this impression, or, as I said, were it so I wouldn't stay in Los Angeles As far as the undesirability of it, again I defer to nobody in wanting to get rid of it.

Mr. ROOSEVELT. In other words, you emphasize its nuisance value.

Dr. KOTIN. Nuisance and irritational value. We have studied people who are not marginally sick but who are actually very close to the mortal state in hospitals in smoggy days. We have had them examined and observed very diligently, and for whatever the observation is worth, in one of the largest hospitals in the world, by the acute observing eyes of a hospital resident staff, again of a caliber that is exceedingly high, we unanimously come away with the impression that while it should be gotten rid of, it is bad from every conceivable esthetic point of view, it might conceivably be bad from even a health point of view, all I submit is that we don't have the data now to establish that and we don't have the data for two reasons: First of all, I don't think our method of testing is subtle enough.

Mr. ROOSEVELT. Before you go any further, what is the name of that hospital so we can have the record?

Dr. KOTIN. At the County Hospital.

Mr. ROOSEVELT. At the County Hospital.

Dr. KOTIN. That was one reason, as I say, the fact that we don't have enough in the way of delicate instruments to measure the reaction of the average person and this, I submit, is a phase of research that needs intensive support, that needs immediate support, and I may say, as a phase of investigation that the United States Public Health Service has been especially cognizant of. As somebody who has been in the field for the better part of a decade, it is exceedingly heartening to know that though overtly some of the research supported by the United States Public Health Service might appear to be remotely related to the measurement of air pollution, nevertheless, it represents a basic approach which over a 10-year period or a 5-year period will result in infinitely more knowledge than can be obtained by just beginning with the assumption that anything that doesn't have smog in the title of a research project is in and of itself unrelated to smog. As I say, that is one crying need for research.

A second crying need for research resides in the fact that I think enough good vital statistics are available for a study, but again before using them the actual blueprint of the investigation has to be established. Again on a purely personal basis, I feel—and in this I think I have the concurrence—I certainly know I have the concurrence of many of the epidemiologists of the United States Public Health Service by their printed words—that as much time as may be spent

working out an excellent plan of study will still result in the accumulation of data much more quickly than just going ahead and using time-honored methods of study which really are not applicable to the present situation.

In Los Angeles, as you well know, you have an exceedingly dynamic population. We are dealing with substances, with irritants that belong to a group of chemical compounds whose very nature, whose very chemical and physical properties probably make them the most difficult group of compounds to study. It is a diabolical plan of nature almost.

Some of the compounds that result from the reaction of the air have a half life measured in micro-microseconds, a thousandth of a thousandth of a second. Because they exist in that dynamic form for such a short time doesn't necessarily mean they have no biological effect; it just complicates infinitely the ability to use them in studies.

So that while I would in no way minimize the desirability, the absolute imperative nature of getting rid of atmospheric pollution, I would submit that suggesting that dire emergencies exist where perhaps an emergency without the modified dire doesn't exist, would in the long run allow time for calm premeditation before implementing research, and I think in every field this is applicable. You could almost show a direct correlation between the amount of time given to thought prior to implementing research and the results rather than the amount of research done and the results.

Again I hold no brief for the United States Public Health Service, but it is phenomenal that an organization as far away geographically from the problem as they are have recognized that this is a necessary step, and politically I suppose it even carries greater implications because it means data maybe 2 days coming later which may lay them open to more censure. I don't know. So that the only quarrel I have with the United States Public Health Service is that they don't have enough money to spend, but this is a quarrel that they are on my side in, so there is really no difference of opinion there.

In relation to lung cancer there, of course, we have a different problem in that again I would submit that living in an urban community certainly increases your liability to the development of lung cancer, but if I thought for 1 minute the likelihood of my getting a lung cancer was less in New Orleans or Chicago or Singapore or Johannesburg, I would go there. But I submit that if you are going to live in a city, this is one calculated risk along with getting run down by an automobile, having noise and whatever else that goes with urban residence.

Mr. ROOSEVELT. You make the point that there is no greater danger of your acquiring lung cancer in Los Angeles than if you lived in Chicago.

Dr. KOTIN. I make the point that there is no evidence that would say so. Again, we don't know enough. I would rather suspect that living in Los Angeles would carry about the same likelihood of development of lung cancer as it would in Chicago. This is purely a guess.

Mr. STEED. Have you seen any studies or have any evidence of any kind to cause you to believe that smog has any effect on the behavior patterns of people?

Dr. KOTIN. My particular specialty is one that deals in the study of structure, morphology, and I submit I know darn little about that. When you are getting into behavior where you are dealing with abstractions entirely, I would have no opinion at all. I just don't know. I know that I react morbidly to smog, for whatever that is worth. It affects my behavior. I get grouchy.

Mr. STEED. I was curious to know whether, say for instance, the crime rate was higher or less or anything of that sort.

Dr. KOTIN. I would have no idea.

Mr. ROOSEVELT. Dr. Kotin, we have been given figures during the last few days with relation to the established danger point. As you know, there were red and green alerts. I don't know what they have now, something else, and if there is one-tenth of 1 percent of a certain contamination that becomes unacceptable and anything beyond that becomes increasingly unacceptable until you reach a danger point. Now, on what basis was this established if there is not sufficient information to justify it? Did they just pull this out of the air?

Dr. KOTIN. You are really hitting below the belt. I was on the committee that got those numbers up.

Mr. ROOSEVELT. I thought you were on the committee, but if you were on the committee that got them up and now you come in and tell us they are of no value, I am a little mixed up.

Dr. KOTIN. I didn't say they are of no value. What I did say was this: That every third line of the protocol which established those numbers emphasized, one, that they were a starting point for future regulatory operations. There was emphasis and reemphasis that these numbers were not static but were subject to change, modification, revision on the basis of the accumulation of new data.

Mr. ROOSEVELT. When were they established?

Dr. KOTIN. Approximately 2 years ago.

Mr. ROOSEVELT. Now, in the 2 years which have followed, have you felt that they should be modified downward or they should be modified upward? In other words, is there more danger or less danger as a result of your 2 years' work?

Dr. KOTIN. Two years sounds like a long time. I guess it is a long time. The numbers were established with the view that they would be sufficiently large to be practical in terms of running a large metropolis and sufficiently small so that a great safety factor existed. Because of the wisdom of this committee, the numbers were chosen in such a way that they allowed for urban existence and population safety until such a time as data could be accumulated to revise them one way or another. In other words, in all this, the safety factor is so great, the latitudes are so broad, that this is why I say drawing finite conclusions from any data at this time is hazardous. As I say, the latitudes are so great that another 2 years may go by and another 22 years may go by without the numbers being changed and, as I say, without the community being exposed to a dire emergency.

Mr. ROOSEVELT. Is this because there is a lack of data available?

Dr. KOTIN. Yes, and more important than that, a lack of appreciation of the data. The engineers, the chemists can come up with third and fourth decimal places, numbers in terms of exactitude. They can do this in X number of times, but to learn the biological significance of that number is an infinitely more difficult problem.

Mr. ROOSEVELT. You have stated that there is a great range of safety, that they have set it low enough so that we have a great range of safety that we can be sure of.

Dr. KOTIN. That is right.

Mr. ROOSEVELT. If there is all of this lack of material which enables us to do this at the bottom level, how do you know that you have got enough information to tell you that you have this great safety range which you are so sure about?

Dr. KOTIN. Because there is a tremendous accumulation of knowledge on the basis of inplant industrial hygiene information. There is a quasi-official committee which annually sets maximum allowable concentrations of pollutants for inplant exposure.

Mr. ROOSEVELT. They have set it way down here and you tell me it could be safely set way up here.

Dr. KOTIN. This is my own personal opinion. I think one-tenth of a part per million ozone, as an individual I would breathe it 8 hours a day 365 days a year for the rest of my life.

Mr. ROOSEVELT. In spite of the fact that this inplant information has been given which says that it shouldn't go to this point?

Dr. KOTIN. This is my own opinion. I have worked with ozone for the last 3 years. I have an opinion. It is not the first time in my life that I am a minority of one. No, I think that one-tenth of a part per million ozone is in terms of Los Angeles County an excellent warning station and that is all it is. Nobody implied on this committee that a tenth of a part per million represented an immediate health hazard to anyone, and if one-tenth of a part per million had represented an immediate health hazard we would have set it even at five-hundredth of a part per million. As I say, I have yet to satisfy myself that anybody has been adversely affected at one-tenth of a part per million.

Mr. ROOSEVELT. Would you explain to me why you didn't set it at five-hundredths of a part?

Dr. KOTIN. This is so safe and also from what was explained to us so completely impractical in terms of actual operation. In effect I felt I was charged with establishing safety levels consistent with creating as little dislocation as possible, and this is what the industrial hygienist does.

Mr. ROOSEVELT. But you see I am worried about what you have done to the public. In other words, you tell me that we could safely put it at 500 or maybe a good deal further than that, but you actually have put it at one-tenth, then it seems to me that you have unduly alarmed me.

Dr. KOTIN. No, I haven't.

Mr. ROOSEVELT. Because if it is put up at 500 and perfectly safe and you say you would breathe it at 500——

Dr. KOTIN. Five-hundredths, .05.

Mr. ROOSEVELT. You would breathe it at .05 without worrying about it.

Dr. KOTIN. Without any worry about it.

Mr. ROOSEVELT. But you told the public you better look out after we got to .1, right?

Dr. KOTIN. Right, because at this time I want the enforcement control officer to know—he is not doing anything at .1, but I want him

to know it is at .1 and the circumstances, because .1 could just as easily be .2 and .5 or .75.

Mr. ROOSEVELT. However, you did set it at a point at which he ought to do something, didn't you?

Dr. KOTIN. Well, the level of the first alert is .5 parts per million, a half a part per million. At a half part per million we went into our first stage alert, as I recall. Well, at a half a part per million that it is time to worry about what may happen; what is happening has worrying significance only in terms of alerting you for the future. This is my own opinion.

Mr. ROOSEVELT. Then you went one step further and said that I think at one part per million we really ought to take drastic action, everything should be shut down.

Dr. KOTIN. I don't remember what the action consisted of at the time, but one part per million represented a concentration that was worthy of more worry and initiating action.

Mr. ROOSEVELT. But you still don't think it has real danger; you just think we should worry a little more than we did before.

Dr. KOTIN. Danger is a relative thing.

Mr. ROOSEVELT. To me it is not a relative thing. There is a point at which I begin to know that actual damage is taking place.

Dr. KOTIN. I submit that we don't know enough about ozone to know when the actual damage is taking place. We do know that it is safe to breathe it and at a half part per million I submit no one is going to be adversely affected in terms of longevity. No one is going to be adversely affected other than the nuisance and very transient irritant level at the initial level that was established. This is a strange position, my defending the alarm system because again I was his majesty's only opposition in terms of the majority opinion in the formation of that even.

Mr. ROOSEVELT. In other words, you felt that the alarm system was not based upon the sufficient information to properly set it up?

Dr. KOTIN. No. What I did feel was that the necessity for an alarm system even at that time was premature. Maybe I am a non-alarmist.

Mr. ROOSEVELT. You were in the minority in that view?

Dr. KOTIN. Yes. Well, the numbers were formulated, so I was the minority in that view as well.

Mr. ROOSEVELT. Go ahead.

Dr. KOTIN. I have nothing more to say other than living in Los Angeles at this time is a completely irritating, and highly exasperating experience. I submit that I am in no danger from a health point of view any more than the average resident of New York City or New Orleans.

Mr. ROOSEVELT. In other words, there is no need for panic, but there is a definite need to get to work on the problem.

Dr. KOTIN. I have spent the last 5 years of my life working on it. Were it not so, I wouldn't, but I submit that panic is very definitely not the order of the day.

Mr. ROOSEVELT. Congressman Steed.

Mr. STEED. No questions.

Mr. ROOSEVELT. Congressman Sheehan.

Mr. SHEEHAN. Doctor, I might say, like Mr. Roosevelt, you have got me quite confused from your testimony. At one point you say

there are no conclusions to be drawn and at another point you say Dr. Mills wasn't quite correct in his conclusions. Now, you can't have it both ways.

Dr. KOTIN. I didn't say that. Again it is a matter of semantics. I can conclude only facts.

Mr. SHEEHAN. You do conclude facts. Then you just said to Mr. Roosevelt a little while ago when the saturation reaches a certain point something must be done about it.

Dr. KOTIN. If I said it, I said it.

Mr. SHEEHAN. Is that right?

Dr. KOTIN. I didn't say it that way, no.

Mr. SHEEHAN. You agree that this present situation here where you have one part per million of irritants in the air, whatever it is, you are at a danger point, that something should be done about it?

Dr. KOTIN. I said we should be prepared to do things about it.

Mr. SHEEHAN. In other words, it means when you reach that stage either there is something bad about it or we shouldn't do a thing about it, is that right?

Dr. KOTIN. I said at one part per million of oxidants I believe we should begin——

Mr. SHEEHAN. To do something about it?

Dr. KOTIN. To get worried about it.

Mr. SHEEHAN. That is a conclusion, is it not?

Dr. KOTIN. That is right.

Mr. SHEEHAN. Therefore, if the air is perfectly clear you haven't got a thing to worry about.

Dr. KOTIN. That is a truism.

Mr. SHEEHAN. Here is a city in Oklahoma that has no irritants or whatever it is in the air and Los Angeles has one part per million. It would be better to live in Oklahoma than it would be in Los Angeles, wouldn't it?

Dr. KOTIN. No, because in Oklahoma they have probably got four times the amount of sulfur bearing compounds in the atmosphere.

Mr. SHEEHAN. We are just talking about irritants in the smog.

Dr. KOTIN. Wait a minute. Oxidants represent a purely local problem. There is no other city in the country that from the point of view of oxidants per se has the problem we have. They have other pollutants.

Mr. SHEEHAN. That is where you are confusing me and everybody else. We are talking specifically of smog and smog problems here, and when you compare Los Angeles with Chicago or Cincinnati or Oklahoma, I assume that you are talking about the smog problem and not the other things that might be in there. Sure, in Oklahoma you are going to run into dust, which is an irritant, but we are not talking about dust here; we are talking specifically of smog.

Dr. Mills says, if I recall him directly, in attributing these 349 or 350 deaths, he attributes it to a condition whereby people who already have either a lung or heart condition and he says that the smog on very bad days will aggravate that condition and cause a death which would not have been caused had you had free air here. Are you going to say he is right or wrong on that?

Dr. KOTIN. I am not going to say he is right or wrong; I am just going to say I don't believe it. Let's understand one thing here: It

would be a lot easier for me to come here and give you a lot of positive statements, the way of anybody who wants to tread a narrow path. There is nothing easier than my coming here and saying that smog is bad. I will certainly earn the accolade of those to whom it is bad and that is where it would end. But if I am to come to you and shed the very confusing, and it is confusing—I could put a series of chemical reactions on the board that would in an entirely unrelated way show how confusing it is—but if I am to come to you and tell you that because there are no final answers, I must speak with modifications, with apparent contradictions, with limiting adjective clauses, with phrases that seem to negate what I said 5 minutes ago, it is because the situation is that way.

Mr. SHEEHAN. Well, maybe we ought to say we are all confused and we don't know where we are going.

Dr. KOTIN. Well, confusion and lack of knowing where we are going isn't true. There was a time, I am sure, when Einstein was infinitely confused, but he knew he was heading for $DE=MC^4$.

Mr. SHEEHAN. Yes, but at the same time you have led this committee—or I will say myself—to think that maybe there isn't too much danger in smog, and then a little bit later on you use the expression about smog that there is no potentially lethal agent.

Dr. KOTIN. There is danger in water. I drink water every day, but water is a potentially lethal agent. It is all a matter of hypothecation.

Mr. SHEEHAN. It is all a matter of semantics. That is all.

Mr. PRICHARD. I would like to ask one question. Have you received aid in the research that you have been conducting, some grant in aid of some sort?

Dr. KOTIN. Oh, sure.

Mr. PRICHARD. From what source have you received your grant?

Dr. KOTIN. United States Public Health Service.

Mr. PRICHARD. Any other source?

Dr. KOTIN. Oh, I do lots of research. I do research on cancer, and through research from the American Cancer Society, and that represents the entire source of my support.

Mr. PRICHARD. That's all.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. Then you would conclude that smog is a nuisance and we should get rid of it if possible, but that if we have to live with it, we can? Is that your final analysis?

Dr. KOTIN. I conclude from what we know about smog as it occurs naturally in Los Angeles from day to day it is something that should be gotten rid of, but I don't consider it as a threat to shortening my life.

Mr. BISCAILUZ. Thank you. No further questions.

Mr. ROOSEVELT. Any other questions? Thank you.

Dr. KOTIN. You are very welcome.

Mr. ROOSEVELT. We appreciate your information.

It being 12 o'clock, I think the committee will recess now until 1:30. At 1:30 we will hear from Dr. Pottenger and we will then hear from Mr. Griswold of the control district, and I might say at this time that the committee, unfortunately, after those two witnesses, will not be able to hear any more witnesses, but we will be very happy to receive from anybody who has a contribution to make to the committee any

written statements or documents they want to submit for our consideration and the consideration of the staff, and we will hold the record open for any supplementary information for a period of approximately 2 weeks so that others may have that opportunity.

The committee will stand in recess until 1:30.

(Whereupon, at 12 noon, the committee was recessed, to reconvene at 1:30 p. m.)

AFTERNOON SESSION

Mr. ROOSEVELT. The committee will come to order, please. The committee has agreed first to hear very briefly from Mr. Chandler Phillips who was called yesterday to be a witness but unavoidably couldn't be here. Mr. Phillips is going to submit a fuller statement to the committee but we are anxious to have him come forward, if he would, and just present his qualifications as a witness which will go into the record.

I think you have met the rest of the committee. This is Congressman Steed and Congressman Sheehan.

Would you raise your right hand, please? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. PHILLIPS. I do.

TESTIMONY OF CHANDLER A. PHILLIPS, MECHANICAL ENGINEER, GLENDALE, CALIF.

Mr. ROOSEVELT. Would you give your full name and address, please, to the reporter?

Mr. PHILLIPS. Chandler A. Phillips, 1365 East Mountain Street, Glendale 7, Calif.

Mr. ROOSEVELT. All right, Mr. Phillips, you can proceed, and I am going to have to restrict you, as I told you, to a very short appearance, but you go right ahead and qualify yourself.

Mr. PHILLIPS. I am a mechanical engineer registered with the State of California. I was 14 years with the Shell Oil Co., in engineering. I was 3 years with major oil companies as a chemist.

I have had tetraethyl lead poisoning twice. The first time I got it was in 1942. I worked at the refinery then. I went to the University of Southern California. When I came back to the Los Angeles area in 1948 and got into the Los Angeles auto traffic, these symptoms started to recur. I started my research into smog at that time. I tested the air on activated carbon according to Public Health Bulletin 163, and I have talked to Mr. Larson of the APCD many times. Mr. Larson took his samples of lead in the air on filter papers and he found one-fourth the safe-breathing limit of lead. My tests were conducted on activated carbon, and I found twice the safe breathing limit of lead in heavy industrial traffic.

The petroleum industry has increased the amount of lead put in the air from 1941 to 1954 tenfold. When the catalytic cracking process came into operation in the Los Angeles area in 1943 it put over 4 billion cubic feet of exhaust gas daily into the atmosphere that no other refining process ever put in.

Mr. ROOSEVELT. I am going to ask you to turn your chair the other way. I don't think they can hear any of your testimony in the back of the room.

Mr. PHILLIPS. When the catalytic cracking processes went into operation in England, in that year they had 4,000 additional deaths in London and 12,000 in the British Isles. The inventor of this process, the catalytic cracking process, warned them that this process would create air pollution unless the exhaust vapors were controlled.

What the catalytic cracking process did in relation to other processes was this: It could not allow the process to go to complete combustion. They had to add steam in the process, and that added oxygen and hydrogen to the fuel. The fuel contained more oxygen and they had to add a nitrous inhibitor to prevent that fuel from breaking down in storage. This nitrogen and oxygen was added to the fuel and more sulfur was left in the fuel. Every time sulfur has been discovered in a combustion process, it has been one of the major sources of air pollution. Dr. Willis McCabe, director of the APCD, said sulfur was one of the main problems. The petroleum industry gets in 1,500 tons of sulfur in crude oils. Nine of the southern California Edison plants, according to Mr. Griswold, put out over 500 tons of sulfur compounds into the air. I should like to submit this. These plants have no control, but Pittsburgh, when they outlawed the burning of soft coal, they found out by spring their industrial exhausts from their processes to remove the sulfur compounds could be removed and they could continue to burn soft coal. This had never been done in those plants.

The increased amounts of lead brought troubles to present motors, and they began to knock and had preignition troubles. That trouble was magnified, and instead of reducing the impurities in the fuels, they added more lead. Then they brought out a new poison TCP—tricresophosphate. This 1 additive alone in 1 ton will take 46 feet of air over 1,300 square miles just to dilute it to the legal safe breathing limit established by those medical men. The addition of 20 tons of lead today to the breathing atmosphere requires 117 feet of clean air. The 7 tons of bromoline and the 7 tons of phosphorus that they use to expel these impurities at tailpipe level require another 6 or 7 feet each. This makes a total of 167 feet for the poisonous additives to gasoline alone. The 36 tons of sulfur in the motor gasoline can produce over 100 tons of acid and sulfur compounds out of the tailpipes of the car.

I have charts to correlate, and I shall be happy to show them to you.

Mr. ROOSEVELT. Can you submit copies of them for the record?

Mr. PHILLIPS. I will submit copies for the record. Those charts show that in the public health district—there are 10 of them in the city of Los Angeles—that those death rates vary as much as 3 times. The heaviest death rate is in the central district, the next heaviest is the Hollywood-Wilshire district. There is about one-third that death rate in the San Fernando Valley near the ocean where the air has a chance to be purified.

Meteorological reports and reports of the meteorologists will show that less than 5 percent of the air that we have natural inversion in. I can't go into all of that in the short time that I have.

I thank you for the opportunity of talking but I do want to say that I place the blame squarely on the petroleum industry. I have

performed experiments that have removed the impurities from the petroleum products by the old sulfuric acid treating process. I will give you the description of those. I have two lamps here filled with the same kind of gasoline. Only one of them has had the impurities removed. If I may, I would like to light those lamps and show you the difference of the impurities.

Mr. ROOSEVELT. No; I think we better not go into any actual experiments in the laboratory here. We will just take your word for it that it would.

Mr. PHILLIPS. I saw the refinery processes change, and the day the catalytic cracking process started in operation it put out so much pollution that they had to shut the plant down and double the voltage on the Cotterell precipitators to stop it from throwing catalysts out into the air. I also heard in the refinery and I know from experience that one oil company I was associated with burns over a million tons of mercaptons under their boilers every month. I do not think this has been discontinued. The sulfur-removal plants only remove about one-fifth of the amount of sulfur that is in the petroleum products. The rest of it is either expelled or left in the product. These plants could remove and be expanded to three times the capacity now to remove these products from the oil.

Mr. ROOSEVELT. We want to thank you Mr. Phillips. We will accept the additional written material for the record, and if you have other material that you wish to submit, we shall be very happy to receive it. We thank you very much.

Mr. PRICHARD. May I ask you this, Mr. Phillips? This document which has been handed to me starts at the top and says, "Smog, Product of the Petroleum Industry." Is that a summation of your testimony?

Mr. PHILLIPS. That is, and I will submit more information proving this from other scientists.

Mr. PRICHARD. This is one of the documents that you want in the record?

Mr. PHILLIPS. That I would like in the record, and then I will submit other scientific references to verify it.

Mr. ROOSEVELT. The committee will receive it, without objection.

(The information referred to is as follows:)

SMOG—PRODUCT OF THE PETROLEUM INDUSTRY

CHANGES IN REFINING METHODS DURING WORLD WAR II BROUGHT SERIOUS HEALTH-MENACING AIR POLLUTION TO SOUTHERN CALIFORNIA AND 1943 WAS THE FIRST YEAR THAT WIDESPREAD CROP DAMAGE WAS REPORTED

Former method

Thermal cracking.—We had cracked gasolines prior to World War II:

1. The gasoline was cracked in tightly enclosed chambers where none of the dangerous gases escaped into our air.
2. Then the gasoline was treated with 98 percent sulfuric acid which removed—
   (*a*) Impurities of sulfur, nitrogen compounds, oxygen compounds.
   (*b*) Certain reactive hydrocarbons which would have reacted in sunlight to create ozone.

Less lead was needed because more impurities were removed.

Present method

Catalytic cracking.—The change to this type of cracking process caused serious air pollution because—

1. The gasoline is not cracked in tightly enclosed chambers and the dangerous gases are expelled from stacks at the refineries.

2. The gasoline is not treated with 98 percent sulfuric acid treatment and our motor fuels contain—

(*a*) More impurities which make them dirty burning, producing greater amounts of pollution from combustion.

(*b*) More reactive hydrocarbons that will react with sunlight when they escape unburned due to incomplete combustion, evaporation, loading operations, storage, etc.

More impurities required more lead.

Modern method

Hydrocracking.—Not used in the Los Angeles area. This cracking process is the most beneficial for all concerned because it—

1. Increases the yield (to repay the cost of conversion).
2. Reduces air pollution by removing dirty burning impurities:

(*a*) Saturating the reactive hydrocarbons with hydrogen making them nonreactive in sunlight.

(*b*) Increases the heat content of the fuel, causing more complete combustion.

(*c*) Gasolines cracked in enclosed chambers eliminating large emissions of pollution now expelled from catalytic cracking process.

Less impurities require less lead.

The inventor of the catalytic cracker told the petroleum industry that it would cause air pollution. He says they turned down his controls because they were costly and nonproductive. This statement was witnessed by the mayor and city manager of Pasadena. The inventor's controls stop air pollution at refineries outside this area.

TWO TYPES OF POLLUTION FROM AUTO EXHAUST

1. Cancer-forming, health-menacing pollution from combustion (burned gasoline).
2. Unburned gasoline that escapes due to incomplete combustion, evaporation, etc.

The pollution from combustion of gasoline is completely ignored by your APCD, even though some gasolines contain 10 times as much sulfur or 5 times as much lead as another brand. Tests for total pollution have not been made and will never be made until public demand requires that such tests be made.

Hydrocarbons (unburned gasoline) is the single source of Los Angeles smog according to the APCD, W. O. & G. and their researchers.

Lead added to our motor fuels is 167 times more deadly than all hydrocarbon emission.

Smog and air pollution. Do you think they mean the same thing?

They do mean the same thing—to the general public but not to your APCD W. O. & G. and their researchers because they appropriated the word "smog" and gave it a definition to suit themselves. To them smog is the reaction of sunlight with hydrocarbons (unburned) gasolines. Their false definition of smog includes only a limited part of our air pollution and does not include any of the pollution from combustion of petroleum products: gasolines, industrial fuels, and diesel fuels.

While your car is blamed for the major source of APCD smog they are not even talking about the auto-exhaust pollution caused by combustion; they are talking about the unburned portion of the gasoline that escapes from auto exhaust because we have no motor perfect enough to burn all of the gasoline.

After 8 years and $50 million, the stack emissions from every refinery and powerplant here are now being reevaluated because those records are missing from the APCD files (see Magner White's Smog; We're losing the Battle, and Why).

Two methods of making high-octane gasoline for modern motors:

1. Remove the impurities, saturate the hydrocarbons with hydrogen and make a white, clean-burning motor fuel which needs no lead or other additive. American Oil Co., in the East, makes a 96-octane, unleaded white gasoline that will not knock in any modern high-compression motor.

2. The more impurities that are left in our gasolines, the more lead they need to keep it from knocking in our motors. Gulf Refining Co. in the Midwest, removes a teacup of dirty burning tailends from each gallon of their gasoline.

Public acceptance of leaded gasolines has been exploited until it has become a dangerous health hazard in the Los Angeles Basin with our limited air supply. Why did they refuse to release the figures when dangerous amounts of lead were

found in Pasadena last summer even when they were 50 feet in the air making tests? Why not make tests at street level on activated carbon filters instead of their inefficient filters that fail to catch the dangerous gases?

General Motors and Du Pont would be the losers if the oil companies used less lead and removed the impurities which can be sold for a profit as sulfuric acid, ammonia, etc.

Attaching devices to your car is as foolish as purifying water at each faucet.

See Public Health Report 253: TriCresyl Phosphate (TCP * * * The most recent poison added to our motor fuels has made the lead compounds many times more dangerous when expelled from auto exhaust; 5 to 8 percent of lead compounds are retained in the lungs but 47.4 percent of the lead phosphate you inhale is retained in your lungs.

Clean up the refineries: Put 24-hour recorders on the stacks, reduce the present legal limits they are now allowed to expell into our air. Install additional scavenger plants to take over when one breaks down. Ask Francis Packard of Pasadena about the records which show scavenger plant breakdowns 2 days a week.

Clean up the petroleum products used for combustion in this area: Industrial fuel oils: 15,000 industries operating here on various grades of fuel oils, some so low grade they will solidify like asphalt when the temperature drops.

Diesel fuels: The sulfur and other impurities cause dangerous pollution.

Gasolines: 7 million gallons used daily not properly refined for this area.

Property Protectors Federation, 3536 North Figueroa, presents these facts from Chandler Phillips extensive research on Los Angeles smog.

Mr. ROOSEVELT. Our next witness will be Dr. Pottenger. If you will come forward, please, Dr. Pottenger. This is Congressman Steed and Congressman Sheehan over here.

Would you raise your right hand, please? Do you solemnly swear that the testimony you are about to give before this committee shall be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. POTTENGER. I do.

TESTIMONY OF DR. FRANCIS M. POTTENGER, CHAIRMAN OF THE SMOG COMMITTEE OF THE LOS ANGELES COUNTY MEDICAL ASSOCIATION

Mr. ROOSEVELT. Be seated and give your full name and address to the reporter, please.

Dr. POTTENGER. Dr. Francis Marion Pottenger, Jr., 609 North Canyon Boulevard, Monrovia, Calif.

Mr. ROOSEVELT. Then, sir, if you would proceed in your own way, we will be happy to hear you.

Mr. PRICHARD. Will you start, please, by telling us your qualifications?

Dr. POTTENGER. Well, I am a physician, born in Los Angeles County in the city of Monrovia, and I have seen from clean air to polluted air.

Mr. ROOSEVELT. A native son.

Dr. POTTENGER. I have practiced internal medicine in the city of Monrovia, and particularly with respiratory diseases, and I have been interested in the problems of community contamination ever since the beginning of my practice of medicine.

I am a member of the American College of Physicians, Los Angeles County Medical Association, State of California and the American Medical Associations, and a member of various professional and social organizations.

Mr. PRICHARD. Are you on some committee or something of that sort with reference to the county medical association regarding the subject of smog?

Dr. POTTENGER. I am chairman of the Los Angeles County Medical Association Smog Committee; yes, sir. I have prepared a statement here, and I have three copies. That will give you enough to go around.

Now, I will briefly give you a résumé here of what the Los Angeles County Medical Association has done with reference to the smog situation here.

This committee held its first meeting in December of 1949 at the request of Mr. Gordon P. Larson because of the numerous complaints that he had had from physicians with reference to the effects of smog on their patients. In January 1950, the smog committee was made an official committee of the Los Angeles County Medical Association, appointed by the president for the purpose of formulating policies for the association and suggesting ways and means whereby adequate studies of the effects of air pollution on the human being could be instituted.

Prior to the formation of this committee, the Los Angeles County Medical Association had taken an active part in encouraging the passage of the Stewart bill which made the air pollution control district possible. At the conclusion of this effort, this committee was disbanded.

Mr. ROOSEVELT. The Stewart bill is the bill that was passed by the California Legislature?

Dr. POTTENGER. The State Legislature of California; that is correct.

The present committee consists of 13 members of the Los Angeles County Medical Association representing men in various fields of medical activity. The three medical schools have been represented. We have also had men in advisory capacity discuss problems with us. Our first project was to ascertain the extent of knowledge of the toxicology of air pollution. We set about to acquaint ourselves with the technical biological aspects of smog, and have had outstanding research workers of the Los Angeles area discuss with us the various aspects of air pollution. We have also discussed the problem with industry.

In early 1950, a subcommittee took up with each of the medical schools the problem of medical research and asked them to present us with proposed studies and budgets. This was accomplished. In May 1950, at the request of the association, a public meeting was held for the purpose of laying before the community leaders, including representatives of the board of supervisors, chambers of commerce, and other civic and political bodies the need for the study of the toxicology of the atmosphere in order to aid in its control. At this meeting, our host, Dr. Stafford Warren, discussed his plan which consisted of an adequate building which would house all of the air pollution control and air pollution research facilities capable of doing fundamental toxicological studies. The sum of money, roughly $1 million for the building, and the period of 10 to 15 years of study, staggered many. Although the Los Angeles County Medical Association has firmly stood for a determination of toxicological standards of the various pollutants of the atmosphere, both singly and in combination, we have

found it impossible to get the public support necessary to finance such studies.

In August 1950, a questionnaire was sent out to the entire membership of the association, asking the opinion of the doctors with reference to the effect of smog on their patients. Of the 4,700 members at that time—now it is nearly 7,000—who received the questionnaire 2,803 returned it, which was over 60 percent of the members of the association, showing the keen interest of the medical men in the problem; 104 stated that they had no opinion; 138 stated that they did not think smog was harmful—each of these two groups was contacted by the association, and it was found that nearly all of these men were either living out of the metropolitan basin or were retired—2,561 felt smog was harmful to some system of the body. The results of this survey were brought to the attention of the Los Angeles County Board of Supervisors, and a commission for the study of environmental contaminants was formed, consisting of 3 members from each of the medical schools, 3 from the California Institute of Technology, 1 from the research department of the Cedars of Lebanon Hospital, and 1 osteopath, plus the then State health officer and the executive member, the superintendent of charities.

The smog committee continued its activities throughout this time. In June 1953, at the request of the association, the Automobile Manufacturers Association sent their representatives to discuss the problem of smog with the committee.

In September 1953, the council of the Los Angeles County Medical Association went on record and released to the press the statement that it is the opinion of the Los Angeles County Medical Association that it is basically logical and absolutely essential to investigate the deleterious nature and sources of air pollution and its effect upon the health and life of human beings, animals, and plants. The council also went on record as favoring adequate investigation of atmospheric contamination and its effect on human beings and that the general public should be educated in their individual responsibility in the matter.

In October, Dr. Paul Foster, president of the Los Angeles County Medical Association, using the material gathered by our committee, published in the bulletin of the association an open letter to the mayor of Los Angeles, bringing to the attention the previous recommendations of the committee. He particularly pointed out that the first step in the cure of smog is an accurate diagnosis, something which can be done by instituting research programs such as the one drawn up by the medical school and the atomic energy project of the University of California at Los Angeles.

In late 1953 the Beckman report appeared, recommending that no funds be set up for medical research, but that all available funds be spent in devising methods of cleaning up the smog.

In answer to the Beckman report, the smog committee communicated with Hon. Goodwin Knight, stating that a program for medical study on the effects of air contamination on human beings should be set up concurrently with the study to eliminate smog, feeling that a clean source of air is as essential to the welfare of the people as clean water and food. As new contaminants appear with advancing technology, their effects too must be scientifically determined.

In January of 1954 the Los Angeles County Medical Association, upon the recommendation of the smog committee, sent a letter to Governor Knight, the president of the Los Angeles City Council, Mr. John S. Gibson, and to Mr. John Anson Ford, chairman of the Los Angeles County Board of Supervisors. The salient points of this letter were that air pollution has been known with certainty to cause human fatality, that smog is an unquestioned irritant to certain mucous membranes. The county medical association resolved that air pollution is a health hazard that may terminate fatally. It is the responsibility of the local government to eliminate air pollution. It is recommended that biological studies be devised to determine the toxicological effect of air contaminants, and urged that studies be made to determine whether air contamination affected the food supplies adversely, that studies be made of the therapeutic measures necessary to counteract the ill effects of smog.

On March 11, 1954, the Los Angeles County Medical Association sent a further letter to the Los Angeles County Board of Supervisors, urging the determination of those contaminants which are health hazards, in what concentrations they are harmful and the length of exposure necessary to produce damage; to investigate measures to alleviate smog-caused ills of the population. It recommended adequate equipment, facilities, and personnel, either through the cooperation of existing facilities or the establishment of new facilities. It proposed that the county of Los Angeles build an adequate facility on county-owned property, in close proximity to the administrative control offices of the air pollution control district, for proper liaison. That the facility be administered by an executive toxicologist whose duty it would be to coordinate all efforts directed to the study of air contaminants in the area. That the supervisors seek funds for the purpose of carrying out this study.

On June 7, 1954, the council of the Los Angeles County Medical Association directed that letters be sent to the board of supervisors, the Governor and council of the city of Los Angeles, suggesting that a medical adviser be included on committees dealing with smog, and that this adviser have equal vote with other members of such committees.

On October 18 the committee we represented before the closed meeting called by Senator Thomas H. Kuchel by Dr. Kurt T. Shery, who reiterated the stand of the county medical association.

In November the report of the California Air Pollution Foundation was released, and it contained no provision for research on the effect of smog on human health. On November 18 it was again brought to the attention of Herbert C. Legg, chairman of the Los Angeles County Board of Supervisors, that the smog has potentially fatal effects.

The smog committee was represented at a meeting with the Los Angeles County Board of Supervisors at their meeting on December 8, 1954, at the Huntington-Sheraton Hotel in Pasadena. Our plan was discussed, and we were informed that it was not acceptable as it stood and that it should be revised.

On January 3, 1955, the council of the Los Angeles County Medical Association met and voted the following nine resolutions. These resolutions are reiterations for the most part of our previous stand.

1. That air pollution can cause death.

2. That air pollution is a continuing dynamic problem in the Los Angeles area.

3. That the smog committee proposes that biological, as well as chemical, indices must be determined for the safety of human beings.

4. That the smog committee approves in principle the establishment of chemical standards of air pollution as proposed and begun by the county board of supervisors.

5. That the smog committee feels that present chemical standards do not alone safeguard the health of the public.

6. That the tolerance levels of toxicity for human beings of each important contaminant in the atmosphere must be determined both for acute and chronic exposure, both singly and in combination.

7. That the deans of the three medical schools in the area and the California Institute of Technology be requested to prepare a report to the Los Angeles County Medical Association indicating what program each school would propose to determine standards of toxicity of air pollutants, both acute and chronic, and to prepare an estimate of the cost of such a program.

8. That the council of the Los Angeles County Medical Association request each section of the association to send its chairman or representative to meet with the smog committee to make plans for a survey of the membership of the section as to the effect of air pollution on human beings.

9. That the council of the Los Angeles County Medical Association request the county board of supervisors to obtain the cooperation of private, city, State, and Federal agencies in financing the necessary facilities and salaries for biological research to determine critical standards of air-pollution toxicity, utilizing the facilities of all local institutions capable of carrying on such research.

It was considered that the most important phase of these recommendations was No. 8. A meeting of the deans of the medical schools was called, and the committee is awaiting a further report from them.

These nine resolutions were both a reaffirmation of previous stands of the association and supplementary suggestions.

On October 3, 1955, the Los Angeles County Medical Association authorized the formation of a citizens' foundation to obtain for allocation to appropriate research team funds for the purpose of studying the clinical and basic medical research problems dealing with smog, and providing physicians of the area with definite information as to the emergency roll of medical men in case of smog disaster. That such a foundation would be headed by an outstanding medical executive whose prime purpose would be for the correlation of the medical aspects of smog research. Attempts to implement this are underway at this time.

It was passed by the council of the Los Angeles County Medical Association October 3, 1955.

This is the letter of transmittal to the association, and whether you wish that read or not, I will give you the motion that was passed if that will be all right.

Mr. ROOSEVELT. Yes. That will be all right.

Dr. POTTENGER. The important part of the motion was this: It is well known that while large amounts of money and effort have been expended on the engineering and chemical aspects of smog, compara-

tively insignificant funds have been spent on basic medical smog research and its relation to human health in the Los Angeles Basin.

It is a proven fact that the smog menace is increasing and authorities believe it will continue to increase as the population grows, motorcars increase in number, industry expands in this area.

The smog committee recommends that a nonpolitical citizens foundation be created for the purpose of obtaining funds for allocation through appropriate research teams for study of the health aspect of smog, both from a clinical as well as the basic medical research standpoint.

Now, it tells a little bit about what should be done, and that I believe is not important to this meeting here.

That is roughly the report.

Mr. ROOSEVELT. Thank you, Dr. Pottenger. You have raised some interesting points here and I am sure there are a few questions that the committee would like to ask you, if you don't mind.

First, let me ask you whether the recommendation, the letter which you sent to the board of supervisors on March 11, 1954, which is referred to on page 5 of your statement, resulted in any action that you know of by the Los Angeles County Board of Supervisors?

Dr. POTTENGER. Numerous meetings were held between representatives of the supervisors and of the committee, but nothing concrete, to my knowledge.

Mr. ROOSEVELT. Was there any followup to the proposal that there be built adequate facilities on county-owned property in close proximity to the administrative offices of the air pollution control district for proper liaison?

Dr. POTTENGER. That has not been carried out.

Mr. ROOSEVELT. Therefore, of course, no executive toxicologist for the duties you have outlined has ever been appointed; is that correct?

Dr. POTTENGER. The air pollution control district has a toxicologist, but not a medical toxicologist primarily.

Mr. ROOSEVELT. As far as you know, the supervisors sought no funds for this study?

Dr. POTTENGER. As far as I know; yes. I couldn't answer that.

Mr. ROOSEVELT. You state in November the report of the California Air Pollution Foundation was released. What is the California Air Pollution Foundation, for the record?

Dr. POTTENGER. Well, the Air Pollution Foundation is the group here in Los Angeles headed by Mr. Hitchcock.

Mr. ROOSEVELT. Is that a privately financed organization?

Dr. POTTENGER. Yes.

Mr. ROOSEVELT. It has, however, I believe received funds from the board of supervisors for the conduct of its operation.

Dr. POTTENGER. They have made application for funds, yes.

Mr. ROOSEVELT. But they have not received them?

Dr. POTTENGER. I believe they have received some funds, but I can't tell you the exact amount.

Mr. ROOSEVELT. I believe they have. This is not an official but an unofficial body; is that correct?

Dr. POTTENGER. No.

Mr. ROOSEVELT. Now, on page 6 you state that the smog committee was represented at a meeting with the Los Angeles County Board of Supervisors at their meeting on December 8, 1954 in Pasadena and

that your plan was discussed at that time and was not acceptable and should be revised.

Now, could you detail a little bit why wasn't it acceptable and what revision was suggested?

Dr. POTTENGER. Well, it apparently was the feeling of the board of supervisors at the time that the study of the human aspect of air pollution was not just a matter for local study; that it is a matter of worldwide interest and therefore should not be foisted on the taxpayers of Los Angeles County; that it is something that if it were going to be carried out should be carried out on a much broader basis.

Mr. ROOSEVELT. In other words, they didn't feel it was the duty of the county board of supervisors to undertake and initiate this, that they felt they would only begin it if it was part of an overall larger program that started at a higher level?

Dr. POTTENGER. That was the feeling at the time; yes.

Mr. ROOSEVELT. Has that feeling changed, do you know?

Dr. POTTENGER. I don't know that it has changed. I couldn't answer that question.

Mr. ROOSEVELT. Have you seen any evidence of a change of point of view?

Dr. POTTENGER. No evidence of change; no.

Mr. ROOSEVELT. Now, on October 3 of 1955, the Los Angeles County Medical Association was urged to begin the formation of a foundation headed by an outstanding medical executive, and you state that attempts to implement this are under way at this time.

Now, we are now getting to the latter part of the month of May and that is October. Is there any progress in this field or what hope has the community got that progress can be made? In other words, if real progress hasn't been made by now, is there a good reason it hasn't been made, and is there anything that you think might lead to eventual accomplishment of the suggestion?

Dr. POTTENGER. Yes; there are numerous mitigating circumstances. From the association's standpoint practically all of the efforts of the association up to January were placed on a medical convention that was held in Los Angeles and the men didn't have the time to put their efforts to further work at that time, but since that time efforts have been gradually working out toward the implementation of this program and two important meetings have been held. It is a difficult thing to get practitioners out to consecutive meetings and once a month is rather hard—is enough in itself for most men.

Mr. ROOSEVELT. Do you think that there is substantial hope that such a foundation will be put into operation in the near future?

Dr. POTTENGER. We hope so. We are working on it.

Mr. ROOSEVELT. But you couldn't say concretely that there was any immediate prospect of its achievement?

Dr. POTTENGER. Not that we can see immediately; no.

Mr. ROOSEVELT. Now, you have made certain definite statements or conclusions and I assume that these are backed by statistics or reasons to have reached them, for instance, one, that there is a definite relationship from smog conditions to fatalities in the area. Have you any that the county medical association could submit to the committee to substantiate that? I have a particular reason for asking that. There was some conflict in the testimony this morning, in the testimony given to the committee, and the committee would therefore, of course, appre-

ciate such factual information as could be made available to it to substantiate the conclusions that were reached when you presented the report to the county board of supervisors.

Dr. POTTENGER. That was on the basis of the information submitted to the committee by members of the committee on the basis of known deaths due to air pollution, such as the records that we have from London, such as the records we have from Donora, such as the record from the News Valley, and from Mexico and other places in which air pollution has been known to cause death. Now, as to the Los Angeles area, we do have information that death certificates have been signed as air pollution—as a contributing factor.

Mr. ROOSEVELT. Can the committee receive photostatic copies of those certificates of death which can be made part of the record?

Dr. POTTENGER. Of course, we haven't that available to us.

Mr. ROOSEVELT. Are those public records that are kept——

Dr. POTTENGER. By the State.

Mr. ROOSEVELT. By the county or State?

Dr. POTTENGER. By the State; yes.

Mr. ROOSEVELT. Could we request, if possible, that you give the committee information as to how we could secure those, where to look in other words.

Dr. POTTENGER. I will look up those date references as to them.

Mr. ROOSEVELT. I would appreciate it very much.

The Chair would like to recognize the presence of the distinguished sheriff of Los Angeles County and the father of the committee's counsel, Mr. Biscailuz. We are very happy to have you, Mr. Sheriff.

Sheriff BISCAILUZ. Thank you.

Mr. ROOSEVELT. We appreciate your presence, sir.

Mr. Steed?

Mr. STEED. I believe you said a considerable part of your practice has to do with respiratory cases. Have you ever had a case that you felt that you should advise your patient to leave the smog area in order to insure their recovery?

Dr. POTTENGER. Yes; I have.

Mr. STEED. Do you know whether other doctors also have felt that in cases before them that that sort of advice should be given?

Dr. POTTENGER. We have such information before our committee; yes.

Mr. STEED. The reason I asked that question, I just want to point out that would be very clear proof that smog does have something to do with health and also that when a patient receiving treatment is advised by his doctor to leave the smog area, that it involves considerable expense on the part of the patient to recover his health over and above what would otherwise be true.

You also said that you lived here all your life in this area. Is it your opinion that this situation gets steadily worse year by year, this smog situation?

Dr. POTTENGER. Well, it certainly has in the foothill area where I live.

Mr. STEED. Now, is that currently true in view of the fact that we are told that a great deal of work is being done here to abate smog? In spite of these efforts, does it continue to worsen, in your opinion?

Dr. POTTENGER. We have had some very fortunate wind currents this year that have helped to clean the atmosphere. I don't think that

any criticism, even though the smog apparently is increasing in the foothill areas, is a criticism against the group of men who have been honestly trying to control it.

Mr. STEED. Well, the reason I asked that question, if it is true that despite the work being done to abate it, if it continues to get worse, a lot will have to be done to make any headway to begin to solve the problems, and if you stop doing what you are already doing, it would get even worse still, and it points up the fact that even with a lot of effort the growth of the community and the changing economic and industrial conditions poses a continuing and an increasing problem of pollution.

Dr. POTTENGER. Yes. That is the feeling of our committee very definitely that it does, and from my own standpoint I would say very definitely that is true; that with each increase in combustion that we add to the atmosphere that we have just that much more contamination to get rid of.

Mr. STEED. It would be indicated then that the increases are about as much if not more than the decreases, so that you are actually losing ground despite the fact that you are doing many things to abate the smog.

Dr. POTTENGER. I think that is very true.

Mr. STEED. That is all.

Mr. ROOSEVELT. Mr. Sheehan.

Mr. SHEEHAN. Dr. Pottenger, on page 2 you make the statement about the medical association standing for a determination of standards, but you say,

> We found it impossible to get the public suport necessary to finance such study.

What do you mean by "public support"?

Dr. POTTENGER. In public support there, we refer both to the public itself that was approached directly when we held a meeting, as was mentioned here in May.

Mr. SHEEHAN. There was an attempt made to get voluntary contributions?

Dr. POTTENGER. Yes.

Mr. SHEEHAN. And the public didn't help too much?

Dr. POTTENGER. No, and the other point was that at that time the air pollution control district, the board of supervisors and even the State had not come into the picture at that time, but the county was already busily active and they were doing their best to eliminate what contaminants they could.

Mr. SHEEHAN. Did your group as a medical association attempt to get any help from the State?

Dr. POTTENGER. Indirectly, yes; not from the State, no, but from the Federal Government.

Mr. SHEEHAN. You did make an attempt from the Federal Government?

Dr. POTTENGER. Yes. We helped to support the applications of four research studies in the smog. Now, I can't tell you the exact dates on this.

Mr. SHEEHAN. Through what division of the Government?

Dr. POTTENGER. The United States Public Health.

Mr. SHEEHAN. The United States Public Health?

Dr. POTTENGER. Yes.

Mr. SHEEHAN. Did they formally turn down your application or didn't act upon it?

Dr. POTTENGER. Most of the applications that the County Medical Association has endorsed have been acted upon favorably, such as the work of Dr. Motley, Dr. Kotin and some of the work at UCLA has been favorably acted upon by the United States Public Health Service.

Mr. SHEEHAN. But this one was not?

Dr. POTTENGER. No. We did not approach the United States Public Health from the standpoint of building an institute for the study as was proposed by Dr. Stafford Warren; no.

Mr. SHEEHAN. Mr. Roosevelt alluded to the fact this morning one of the witnesses came out with the flat statement that this smog had no effect on health, and I notice throughout your material here that you have definite references to the fact that air pollution has been known with certainty to cause human fatality and things like that, and, of course, your survey here of the 2,803 doctors—of the 2,699 who answered, only 5.1 percent held to the opinion that it was not harmful. In other words, the vast opinion of practical medical opinion in the district here is that it is very harmful to health.

Dr. POTTENGER. Yes.

Mr. SHEEHAN. Or let's say harmful.

Dr. POTTENGER. Yes. There have been two medical surveys made. One was made in the city of Long Beach by the health doctor, Dr. Luvac, prior to the county medical study, and his results were almost identical to those of our association, only on a smaller basis.

Mr. SHEEHAN. A smaller basis. As a medical man and as one who is very active in the medical association, your opinion then would very definitely be that smog does have harmful effects?

Dr. POTTENGER. Yes.

Mr. SHEEHAN. And that is the opinion of the vast majority of the medical profession, you would say?

Dr. POTTENGER. Yes, and the association has so gone on record.

Mr. SHEEHAN. In fact, I see that in your statement on page 5 that statement is very emphatic in the fact that on November 18 that it was brought to the attention of Herbert C. Legg, chairman of the Los Angeles County Board of Supervisors, that smog has potentially fatal effects.

Dr. POTTENGER. Which page did you say?

Mr. SHEEHAN. Page 5, at the bottom of page 5, the last sentence.

Dr. POTTENGER. Yes, that's right.

Mr. SHEEHAN. In other words, in this particular opinion, it is not just a small effect but it might be even fatal under certain conditions

Dr. POTTENGER. It could be fatal; yes.

Mr. SHEEHAN. That is all, Mr. Chairman.

Mr. ROOSEVELT. Mr. Prichard.

Mr. PRICHARD. I would like to ask this: Much of what you have expressed, Doctor, is a summation either of the combined opinion of the committee or the combined opinion of the medical profession. Do you subscribe to the proposition directly that smog produces a pathological effect in human beings?

Dr. POTTENGER. Not all of the effects can be demonstrated by our present methods, but I certainly feel so from my own work. To make

this clear to you, what I am reporting here to you today are practically entirely official acts—these are official acts of the association, both the council of the association——

Mr. PRICHARD. We had a witness here this morning who rather pooh-poohed the idea that smog was anything more than an irritant, that there was no demonstration of any kind that smog affected the health of people in any way; just irritated them.

Now, do you subscribe to that doctrine?

Dr. POTTENGER. Well, an irritant can cause a lot of trouble. We are getting into argument with words, but when a patient comes to you with an eye that is watering so he can hardly see, that is an irritant all right, but it is also a pathological condition. To be able to say to you that that is going to cause some serious illness, that is going to make him lose his sight, that is a different story, but as far as that patient is concerned if he can't see on that day or cannot see well and cannot carry on his work, he is ill. He is suffering from a condition that is definitely pathological.

Mr. PRICHARD. Do you agree or disagree with the conclusion that the presence of air pollution has a tendency to increase the incidence of lung cancer?

Dr. POTTENGER. I can't answer that from my personal experience, but I can say to you this: I am seeing in my private practice more lung cancer than I ever saw before, and I have been associated with pulmonary diseases ever since I have been in the private practice of medicine.

Mr. PRICHARD. Now, we had testimony here this morning to the effect that a survey had disclosed the fact that on smoggy days the number of deaths attributable to either a pulmonary or cardiac condition was larger than was normal on the average day of the year. Do you think, yourself, that the smog, the air pollution is a contributing factor in some degree to deaths either from pulmonary or from cardiac conditions?

Dr. POTTENGER. I believe that it can be the deciding factor that can put over an individual who is on the margin.

Mr. PRICHARD. Have you yourself conducted any investigation of your own to ascertain for yourself the conclusion as to whether the smog has been in actuality the contributing cause to the deaths that are increased in number on the days indicated?

Dr. POTTENGER. No I have not conducted such an experiment myself.

Mr. PRICHARD. Do you think, Doctor, that there is a rather large field of inquiry to be pursued in order to arrive at satisfactory conclusions regarding the effect of smog upon the health of community?

Dr. POTTENGER. Yes. We feel, the association feels very definitely the correctness of your question there, namely that it is necessary that very critical studies be made in order that we can conclusively state as to what the smog actually does.

Mr. PRICHARD. I understand, Doctor, that some group—and I have forgotten just at the moment which it was—had fixed the maximal intensity of air pollution which was regarded as allowable for inplant breathing on the part of persons who are working in industrial plants. Was that sponsored in any way by the medical society or association?

Dr. POTTENGER. Well, the standards of the industrial toxicologists are set regularly. I am not sure of the exact number of chemical com-

pounds. It is somewhat around over 125 compounds of which we have definite toxicological limits that stand up in court. Those are changed from time to time by the meeting of the industrial physicians who are interested in that work. It usually appears in one of the industrial journals about once a year to tell whether any of these standards have been changed.

Mr. PRICHARD. Well, do you think that it is significant, Doctor, that the air pollution control district has indicated a limit which is about 10 times higher than the limit established for inplant consumption, if you want to call it that.

Dr. POTTENGER. You probably have reference to the ozone content of our atmosphere.

Mr. PRICHARD. That is right.

Dr. POTTENGER. Well, there has been a great deal of argument about that particular standard that I have heard from both sides from men who have worked with it. There is a belief that there are different methods of determining the ozone content and that the method that has been used here locally is slightly different from that which was used, for instance, in Cincinnati.

Mr. PRICHARD. Do you think there should be a difference in standard for inplant operation and for the general community at large?

Dr. POTTENGER. It depends upon the length of exposure. In other words, the effects of any contaminant on an individual are of two types: First, times versus exposure, and maximal instantaneous exposure, and as far as a contaminant in a community is concerned, it certainly should not exceed the industrial level.

Mr. PRICHARD. Doctor, has your committee conducted any experiments to ascertain whether the maximum figures allowed by the air pollution district have lasted for a particular period of time or averaged out the intensity of pollution over a period of time, to ascertain whether the intensity over a period of time corresponds with the inplant allowance or not?

Dr. POTTENGER. No, we have not done that work.

Mr. PRICHARD. Well, would you say that such investigation ought to be conducted?

Dr. POTTENGER. Yes, those things should be conducted.

Mr. PRICHARD. What agency would you suggest ought to conduct that kind of an investigation?

Dr. POTTENGER. Well, of course, remember that the committee of the association is not a research committee; it is an advisory committee of policy for the association.

Mr. PRICHARD. Does the association have any research committee or organization operating in the field of research?

Dr. POTTENGER. The association has a fund which they operate and which they give to organizations that are set up to do specific studies. There have been no grants made to my knowledge for air pollution from the association, from the funds.

Mr. ROOSEVELT. Mr. Prichard, if I could interrupt there. Doctor, would you give us your opinion as to whether it would be a proper function of the Public Health Service, the United States Public Health Service, to establish such standards?

Dr. POTTENGER. Yes; because they have contributed materially to the setting up of these other standards that we have.

Mr. ROOSEVELT. Therefore, in your opinion, it would be a proper function for them to correlate that work and to set specific standards in localities that could be used as the standards in those localities?

Dr. POTTENGER. Yes. I might say in the publication of the standards for industrial medicine, it very definitely states in there these must not be taken for community contamination at all.

Mr. PRICHARD. Let me ask this one further question, Doctor, and then I am done. Do you think that the public health aspects of the smog problem here in Los Angeles County are at this point sufficiently acute as to justify an investigation of it in some degree for the purpose of establishing standards or otherwise by the Federal Government?

Dr. POTTENGER. I do.

Mr. PRICHARD. That is all I want to ask.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. Just one question.

Have you found or do you have any figures to show that there is a large incidence of lung cancer cases and pulmonary disorder cases among long-time residents of Los Angeles? Is there any correlation?

Dr. POTTENGER. I dont' know of any study of that kind although it could have been done.

Mr. BISCAILUZ. Do you know from your own knowledge the average age of these patients and their length of residence here in Los Angeles?

Dr. POTTENGER. No, because my patients come not just simply from Los Angeles County. They would have come from elsewhere just as well and from outside of the State just as well as in the State of California. It would be a very interesting study, but I do not know it has been made.

Mr. BISCAILUZ. The study then would have to be confined to the citizenry of Los Angeles to be of any value, is that not true?

Dr. POTTENGER. Yes. Of course, the deaths from lung cancer are obtainable from the State health department, but not as to longevity of residents in the city, to my knowledge.

Mr. BISCAILUZ. Thank you, Doctor.

Mr. ROOSEVELT. Doctor, before I turn you over to the press, who, I think, want to take your picture, can I ask you one more question: On page 3 you refer to Dr. Paul Foster—in October, I believe, of 1953—as stating that he particularly pointed out that the first step in the cure of smog is an accurate diagnosis.

Dr. POTTENGER. Correct.

Mr. ROOSEVELT. I wanted to be sure that I understood that sentence. By that do you mean that there was not at that time available specific data from which the medical profession could say that injurious smog came from any particular source, either industrial or automobiles, or backyard incinerators or whatever it might be? Is that what you had in mind and, if not, what does it refer to?

Dr. POTTENGER. We were not blaming any particular source of air pollution. We were considering air pollution as a total problem in our statement. I can read to you this exactly as it appear in the bulletin of the Los Angeles County Medical Association, September the 24th, 1953, if you would like me to.

These are his proposals:

May we, doctors of this community, offer you a prescription for a handsome, healthy and long-lived city and body of citizens, with the earnest hope that your administration will be the ones to cure our sick air. The doctors of this city offer you every cooperation and suggest, No. 1, the first step in this cure is an accurate diagnosis, something which can be done by instituting a research program such as the one drawn up by the medical school atomic energy program at the University of California at Los Angeles as outlined on the opposite page.

Mr. ROOSEVELT. What did that mean? Specifically, what do you mean by "an accurate diagnosis"? Do you mean the causes, the places from which smog comes, or what specifically does that refer to?

Dr. POTTENGER. Well, it refers to this, Mr. Roosevelt: What in the atmosphere in the first place is causing us trouble. Naturally it comes into the engineering project and problem of determining where it comes from and what the aerometric problems of distribution and all of that are. So those are strictly outside of the problem of the medical side, but what does it do to the human being is a problem that must be studied under the manner in which they suggest in this article.

Mr. ROOSEVELT. Do you think any progress has been made along that line since——

Dr. POTTENGER. Yes; to the extent that we have had through the State board of health some very definite surveys made of smog deaths as published by the State and a new one that has just come out this year. There have been two. There have been some projects that have gone on toward the determination of some of these factors, such as by Dr. Kotin out at the University of Southern California and the county hospital, and Dr. Motley's work, and work that is now going on at the University of Southern California. But what we are talking about is the determination of a critical standard which is somewhat different from—these are, you might say, pilot studies to give an indication of what should be done that have gone along so far.

Mr. ROOSEVELT. Do you want to read the rest of it?

Dr. POTTENGER. All right. Then the second step. The second step is an emergency measure.

Galvanizing local officialdom into the action necessary to eliminate known causes of smog. We believe a concerted action, determined and honest, can lick the problem more quickly than is ordinarily suggested. We believe that time and cost must come second to our citizens' health. About those tears, they are not just caused by local eye irritation. They have a deeper source in the knowledge of what smog can and does do.

Sincerely,

Dr. PAUL FOSTER.

Now, of course, he enters into and discusses the other matters with reference to it, but that was the conclusion of this.

Mr. ROOSEVELT. Thank you. Any further questions?

We want to thank you, Dr. Pottenger, very much and we appreciate your taking the time and trouble to come down and be with us, and now I will turn you over to the tender mercies of the press for a minute.

The committee will now hear from Mr. John A. Maga, chief of the bureau of air sanitation, California State Department of Public Health. You are a public official. We will not swear you, but I think I told you what our custom is.

Mr. MAGA. Yes.

TESTIMONY OF JOHN A. MAGA, CHIEF OF THE BUREAU OF AIR SANITATION, CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH

Mr. ROOSEVELT. Would you again repeat for the reporter your full name and title?

Mr. MAGA. I am John A. Maga—M-a-g-a—chief, bureau of air sanitation, California State Department of Public Health.

Mr. ROOSEVELT. Would you proceed, sir? We will be very happy to hear you.

Mr. MAGA. The State department of public health drew focus on California's growing air-pollution problem last year when the legislature authorized a program of air sanitation. While the department has maintained an active interest in air pollution for quite some time, the 1955 legislature, for the first time, outlined responsibilities of the State in the tremendous task of cleaning California's air.

To carry out this responsibility, the Department has undertaken environmental and medical investigations designed to evaluate the effects of air pollution on health; to determine the factors responsible for air pollution; to conduct statewide surveys of air pollution, and to assist local agencies concerned with such pollution.

The environmental program—and this is the program that I am the chief of—is directed primarily toward a study of conditions actually occurring in the atmosphere throughout the State and include studies to precisely define the nature and mechanism of air pollution and to develop a reliable air-pollution index; establishment of air-monitoring networks in metropolitan areas; assistance to local agencies in establishing long-range air-pollution control or prevention programs and studies of major sources of air pollution in rural areas.

Closely integrated with the environmental studies is a preventive medical program. It has been determined by opinion both medical and nonmedical, by evidence from disastrous occurrences elsewhere, and by the limited data available from California experience that air pollution poses a significant public-health problem, one requiring further investigation because of its obvious immediate interference with the physical, mental, and social well-being of California's people; because of its possible but as yet undetermined, cumulative, adverse effects upon health, and because of its disaster-making potential, should pollution concentration build up in any area.

To determine the health effects of air pollution in California, studies in this program include analyses of mortality of populations exposed to air pollution to determine whether such pollution contributes to death; study of the sickness experience of exposed populations through special surveys of the general population, schools, industrial groups, and admissions to hospitals; investigation of the effects of air pollution on the frequency and intensity of attacks of asthma, hay fever, and other respiratory illnesses, and studies of the influence of air pollution on human performance.

The State department of public health has been giving assistance to local agencies during the formative stages of local air-pollution control districts. This aid has included programs of air measurements, meteorological studies and other engineering work.

California communities are becoming increasingly aware of air pollution, as exemplified by the recent establishment of the San Fran-

cisco Bay air-pollution control district, and activation of a county air-pollution control district in San Diego. The data gathered by this department and local health departments in the San Francisco Bay area indicate that while the smog problem in the bay area is not presently as severe as that in Los Angeles, in either intensity or frequency of occurrence, it can be expected to assume threatening proportions as population continues to increase, industry expands, and unfavorable meteorological and geographic conditions prevail. Other regions of the State also have manifested interest in the problem, and committees have been formed to study air pollution and make recommendations on its prevention and control.

It must be pointed out that the actual control of air pollution in California is the responsibility of local agencies. While the State department of public health can assist in the investigation of pollution problems, assist in establishing air-monitoring systems, and aid in the drafting of control and prevention plans, the real responsibility for control and prevention of air pollution rests with the local agencies.

The department feels strongly that one of its more important contributions to this whole broad problem of air pollution is the coordination of the activities of the many governmental agencies, universities, and other organizations engaged in the study of air pollution.

A good start toward clarification of the air-pollution program was realized in meetings held last July and February of this year.

The department, in July, called a meeting of governmental agencies to review the responsibilities, plans, and objectives of these agencies on local, State, and Federal levels. Represented at this meeting were local air-pollution control districts, the United States Public Health Service, the University of California, and the State department of public health. Out of this meeting came agreement on broad areas of interest and responsibilities of each agency.

In February of this year, the department met with Federal, State, and local governmental agencies, universities, and organizations with interests in air-pollution investigations. One of the purposes of the meeting was to determine what air-pollution investigations were underway or were planned and to consider what additional studies were needed and how these could be financed. It was disclosed that during this fiscal year approximately $3 million is being spent on air-pollution research in California. And it was evident that there were extensive areas of urgently needed research for which funds are not presently available.

Mr. ROOSEVELT. Was most of that $3 million on health, the aspects of health?

Mr. MAGA. No. Most of it was on the environmental engineering, but there were large sums on health, too.

Agencies and physical facilities are available now for undertaking a considerable portion of this badly needed research provided funds were available. It was found that existing research agencies in California and the Los Angeles County Air Pollution Control District could almost immediately undertake new studies costing over $1,500,000 per year if the financing could be done. This sum represents approximately 50 percent of the Federal budget requested for air pollution for the 1956–57 fiscal year and illustrates the need for additional Federal funds to support research.

The importance of solving air pollution in California cannot be emphasized too strongly—not only in Los Angeles and the San Francisco Bay area, but to all of California as well. California communities are in different stages of development, and as a result, are experiencing varying degrees of impairment of air quality. Knowledge on the nature, cause, and control of air pollution is needed to enable communities to plan local control programs. These programs may then be directed at preventing air pollution from becoming a problem, maintaining existing air quality, or in some instances, of restoring air quality that was no longer satisfactory.

At present, air pollution control is hampered by our lack of fundamental knowledge on many aspects of the problem. Correction of existing problems and prevention of air pollution in other areas of the State to a large extent depends upon how soon some of the unknowns of air pollution can be learned.

That is the extent of my statement. I might point out that I am not a doctor. I am an engineer and I am in charge of the environmental program of the department.

Mr. ROOSEVELT. Now, when you say the environmental program, do you mean—could you describe that a little bit more specifically?

Mr. MAGA. Yes. This is the program of making air measurements to determine the concentrations of air pollution, to correlate the data measurements obtained throughout the State from Los Angeles, San Diego, San Francisco, to see the difference, to determine the extent of the problem that exists in the communities, to assist local control agencies where assistance may be needed. Many districts in the State are quite small and do not have large technical staffs as Los Angeles may have, so that there is a need for technical assistance to some of these agencies.

Mr. ROOSEVELT. Mr. Maga, does the State law give you the responsibility or the authority to set standards in the various communities?

Mr. MAGA. Not specifically; it does not give us that. However, if enough knowledge were known, of course, about what standards should be maintained, I think that the standards could be described and accepted generally.

Mr. ROOSEVELT. But specifically the State law does not state that you have the power, for instance, to set what is the acceptable standard for—Mr. Prichard has the word for it——

Mr. PRICHARD. In-plant.

Mr. ROOSEVELT. The proper in-plant——

Mr. MAGA. Well, as I say, not directly, but indirectly it would. The State department of health and the local health departments have very strong laws on public health and they could establish safe limits if these were known, to describe the quality of air, and if these limits were exceeded, then the local department or the State department could take strong action in that event.

Mr. ROOSEVELT. But they have not yet been set up?

Mr. MAGA. That's correct, no standards have yet been set up in this State or any other State.

Mr. ROOSEVELT. What is the present State contribution directly aimed through your department at smog control?

Mr. MAGA. In money you mean?

Mr. ROOSEVELT. In money.

Mr. MAGA. It was $250,000 the first year, which is the fiscal year ending now, and next year it is $300,000 by the State.

Mr. ROOSEVELT. Are there any State funds that you know of expended toward assisting——

Mr. MAGA. There are State funds that are being expended in the University of California for research. I believe that figure is $295,000 for this present year.

Mr. ROOSEVELT. So that including the State university research funds, the total is slightly under $600,000?

Mr. MAGA. That's right.

Mr. ROOSEVELT. In view of the expanded responsibility, would you feel that perhaps the State could do a little mor in exercising its responsibility for leadership in this field and coordinating the efforts of the various——

Mr. MAGA. It is evident that there is needed money for research and the sources are the State, the local agencies and the Federal Government. Now, how this pie is cut up to make it fair is pretty hard to describe. There is a great deal of interest at the State level on this.

Now, in the 1955 legislature there was considerable thought and consideration given to the appropriation of a large sum of money for research. The bill did not pass. Since that time there is an interim committee in the State investigating this and they have questioned the witnesses on the need for additional money and research, and I assume this problem will again be taken up in our next regular session.

Mr. ROOSEVELT. Mr. Steed?

Mr. STEED. If this is a fair question——

Mr. MAGA. This isn't a fair question?

Mr. STEED. I say if this is. You don't need to answer it if you don't want to, but based on your experience do you think they are going to lick this smog problem in Los Angeles?

Mr. MAGA. Well, I think they will. You must define what you mean by "lick." I think anyone who is going to live in a metropolitan area has to face the fact that he can't have the amount of pure air of, let's say, Yosemite, or maybe not Yosemite—there are too many people there, too—but on the top of the Sierras, let's say, and it is obvious that any metropolitan area is going to have to suffer a reasonable impairment of air quality. I think, though, it is reasonable to expect, and certainly I expect, that a community can maintain the quality of air that is satisfactory to live in.

Mr. STEED. Do you agree that public opinion can add or take away a lot of the solution to this problem?

Mr. MAGA. Oh, absolutely. Public opinion is very important in this. The public must support the local programs or any other program and must be aware, I think, of the problem and their contributions and be prepared to accept the limitations that are placed on them, because any air control program is going to directly affect the individual one way or the other and it is going to cost him money. It is going to cost him considerable sums of money.

Mr. STEED. Well, as an outsider who doesn't live in a community that has a problem like this, the testimony, I think, is very clear that you do have a serious problem and it doesn't have any easy or simple solution, and it also kind of leaves the impression with me that these people out here are not all of one mind as to how the thing should be attacked. I get the impression that they have become so preoccupied

with one idea that they get into a position of not being able to see the forest for the trees. It just occurred to me that perhaps if the public could be given a better understanding of the complicated nature of this problem, that it might help those people like in your position to do a better job and a faster job of getting down to some workable answer to it.

Mr. MAGA. That is correct.

Mr. STEED. That is all I have.

Mr. ROOSEVELT. Mr. Sheehan?

Mr. SHEEHAN. No questions.

Mr. ROOSEVELT. Mr. Prichard?

Mr. PRICHARD. I would like to ask just 1 or 2.

I understood you to say that in San Francisco, for example, the smog problem has not yet reached "threatening proportions." I think those are the words you used. I would like to know whether the smog problem in Los Angeles, in your opinion, has reached threatening proportions.

Mr. MAGA. This, I think, will depend a lot upon what we describe as "threatening."

Mr. STEED. My next question is going to be who does it threaten, you know.

Mr. MAGA. The threatening proportions that I referred to in the San Francisco Bay areas is where the area as a whole becomes greatly concerned with the problem and groups are formed because of this, where large numbers of people suffer from eye irritation and where the air-pollution problem, let's say, becomes the most serious environmental problem that the area has to face. I think that is probably the case in Los Angeles. Now, I don't think that is particularly the case in San Francisco, and by "threatening" I meant that rather than a threatening from a medical standpoint. .

Mr. PRICHARD. Your job in your particular spot deals very largely, does it not, with the medical aspect of it?

Mr. MAGA. Yes; it does.

Mr. PRICHARD. There are two areas then within which the problem becomes acute: One is the environmental aspect and the other is the medical aspect; is that right?

Mr. MAGA. Yes. Of course, the two fields are closely related in this broad field. Environment means control of air, water, sewage, food to prevent people from getting sick or dying. So environmental pertains then to the general control, air, water, food, while the medical pertains more to specific disease.

Mr. PRICHARD. Environmental would also include the simple aspect of being irritated with smog; whether it produced any other pathological effect would be unimportant; if it got to the point where it seriously irritated the community so that the general efficiency of people was cut down, it would be critical, is that it?

Mr. MAGA. Our department feels that is a very important aspect of public health. If air pollution interferes with these things that you are describing, then that is a public health problem.

Mr. PRICHARD. Has any study been made to discover whether the irritation produced by smog has any effect upon the neurological behaviorism of mankind?

Mr. MAGA. I can't refer to any specific study along those lines.

Mr. PRICHARD. I understand that they have conducted experiments that if you get sufficiently irritated a sufficient number of times it drives you crazy. Having been irritated to the point of wanting to scream every day for a couple of years, now I wonder how long it is going to be with me.

Mr. MAGA. I don't think any specific studies have been made along those lines.

I have two reports here that the department has prepared on air pollution. They deal in considerable detail on the public health problem and analyses of data of mortality versus smog days.

Mr. ROOSEVELT. I have read these reports with great care, and if you will submit them they will be placed on file with the committee.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. No questions.

Mr. ROOSEVELT. We are very grateful to you for coming, Mr. Maga, and I can assure you we shall keep in touch with you and try to coordinate our efforts with yours.

Mr. MAGA. Thank you.

Mr. ROOSEVELT. The committee at this time will hear from Mr. S. Smith Griswold who is the director of the control district. Mr. Griswold, we are happy to have you with us, sir. This is my colleague, Congressman Sheehan.

Mr. SHEEHAN. How do you do, sir. We have been waiting a long time for you.

Mr. ROOSEVELT. My other colleague will be with us shortly. We are very happy to have you because, as you probably know, in yesterday's—I believe you were here—in yesterday's testimony there were a number of questions which Mr. Will brought up, which he left waiting for you, so if it is agreeable to you why don't you go ahead in your own way and we will proceed from there.

Mr. GRISWOLD. Thank you, Congressman. We have prepared very short statements and very concise based to answer some of the questions that we think have been brought up here. I have brought four of my division chiefs here in charge of the technical aspects, including the director of engineering, director of enforcement, director of the automotive combustion laboratory and the chief engineer of the district. Just two of those I am asking to give a short paper which will clear up many of the questions that perhaps were initiated in your minds by Mr. Will and by some of the other witnesses.

Mr. ROOSEVELT. We would be very happy to hear them. Would you please give your name to the reporter and your title.

Mr. GRISWOLD. S. Smith Griswold, air pollution control officer.

TESTIMONY OF S. SMITH GRISWOLD, AIR POLLUTION CONTROL OFFICER, LOS ANGELES, CALIF.

Mr. GRISWOLD. Smog control in Los Angeles County now has an 8-year-long history and record of experience behind it. The organization which I head—the Los Angeles County Air Pollution Control District—was brought into being in the year 1947. In that year, the State legislature, through an amendment to the State health and safety code, made possible the creation of air pollution control districts in each county of the State. Under the terms of the legislation, local

county boards of supervisors could, under certain conditions, create countywide air pollution control districts whose authority would extend into both incorporated and unincorporated areas alike. Powers ascribed to such districts included the rather unusual right of adopting local rules and regulations having the full force and effect of State law within that district. Organizationally, the districts were to consist of an elective air pollution control board, which would be the county board of supervisors, an appointed air pollution control officer under civil-service status who would serve as executive for the organization, and an air pollution control hearing board, which would sit as a quasi-judicial body for all appeals from actions taken by the air pollution control officer.

With the adoption of this State legislation, local authorities for the first time were able to put into being an organization capable of coping with the mounting smog problem. As a result, in the latter part of 1947 the Los Angeles County Board of Supervisors, by a series of legal actions, created the Los Angeles County Air Pollution Control District. By April of 1948 a staff had been selected for the district and the official county air pollution control program was launched. Since that time, Los Angeles County has spent directly more than $7,350,000 in tax funds for research, developmental, engineering, and enforcement activities. As a result of its program and the adoption of local smog control regulations, industries have been required to install control equipment which has cost more than $35 million to date. Additional research expenditures by industries and private institutions in this area are estimated at an additional $8 million. The cost of operating and maintaining air pollution control equipment and control programs within industries total countless thousands of dollars additional each month.

Although Los Angeles County still suffers from smog, and this year will sustain smog attacks as severe as any which we have ever before experienced, there is nevertheless a substantial record of smog abatement achievement behind us. As a result of the district's program, there are presently more than 1,500 tons of air polluting materials which are prevented from entering our atmosphere each day. To achieve this record, more advanced control measures have been adopted here than anywhere else in the world at any time.

It is to be noted that the air pollution control district has faced many obstacles in its goal to restore clean air to Los Angeles. First among these has been the appalling lack of knowledge available regarding the chemical constituents of smog, their several sources, and methods which can be employed to eliminate them. It is therefore only natural that a great portion of our total expenditures have been directed toward basic and applied research aimed at determining both the causes and cures of smog. This program is far from being completed.

Briefly, by way of summary, it is to be noted that four groups of materials have been identified by local research to be significant contributors to smog formation: (1) Solid and liquid particles which are technically termed "aerosols" and "particulate matter" have been demonstrated to contribute markedly to the reduction of visibility associated with smog attacks and are believed also to contribute to the eye irritating properties of smog; (2) oxides of sulphur, under certain conditions and concentrations, react in the atmosphere to form

visibility reducing hazes, eye irritants, and crop damaging components; (3) hydrocarbons and other organic compounds have the apparent abiltiy to react in the atmosphere with oxides of nitrogen under the presence of sunlight to form materials which irritate eyes, reduce visibility, and damage vegetation; (4) oxides of nitrogen, as indicated, are partners with hydrocarbons and other organic compounds in this key atmospheric reaction.

On the basis of these research findings, positive control efforts have been directed toward each of these key elements and their several sources of emission. Local rules and regulations have been adopted by the air pollution control district on dusts and fumes, particulate matter, hydrocarbons, sulphurous contaminants, and other combustion contaminants.

Specific research is underway at this time to determine methods of controlling oxides of nitrogen.

Our present program, as will be explained in further detail later, consists of further research to identify all the sources of each of these contaminants, their relative importance in the smog picture, and feasible methods of control which may be applied to their reduction.

To assist in achieving this end, no equipment may be constructed, leased, altered, or purchased in Los Angeles County without the prior approval of the air pollution control district. This requirement has created the need for the largest air pollution control engineering organizations in the world.

To assure that all control equipment is properly operated, and that State laws and all local rules and regulations are properly observed, we have adopted a most vigorous enforcement program. That the district is carrying on such a program is evidenced by the more than 3,000 court cases taken against smog law violators during the calendar year 1955 alone. It is interesting to note that each month our enforcement activity results in more than 2,000 inspections of industrial plants and the issuance of more than 3,000 citations against smog law violators.

This, in brief, is a picture of our local program. That we have not yet solved the smog problem is clearly apparent, and that we have a great deal more to do is equally obvious. But it is apparent also to us that the job remaining is one that must concern not merely the local air pollution control district, but with equal vigor, also, private industries, State government and Federal Government. The problem we face here in Los Angeles is one that in varying degrees could happen, and it is happening, in every other major metropolitan area of this Nation. What we are learning, and what we are doing about this problem here is therefore of benefit not only to Los Angeles but a potential benefit to every other major metropolitan area.

To explain in further detail the peculiar chemical properties of Los Angeles smog and what types of controls have been instituted to correct it, I should like to present two technical men of the district. One is Dr. Leslie Chambers, lately director of research of the United States Public Health Service, Taft Engineering Center, and now with the air pollution control district. I thought that following that, in describing our engineering program, the permit system, which is one of the main pillars in maintaining the status quo, in other words, in requiring all industry coming in here to have the most effective control devices installed before they even commence to operate, that the direc-

tor of engineering could give you some statistics which would include, among other things, the growth of industry in this area.

Mr. ROOSEVELT. Thank you very much.

Mr. GRISWOLD. Dr. Chambers. I will be available.

Mr. ROOSEVELT. We are going to want to ask you some specific questions, but if you prefer to have them come on first, why, we will hear from them first.

Mr. GRISWOLD. Please.

Mr. ROOSEVELT. Fine. We are very happy to have you with us, sir. Please give us your full name.

TESTIMONY OF DR. LESLIE A. CHAMBERS, DIRECTOR OF RESEARCH, AIR POLLUTION CONTROL DISTRICT, LOS ANGELES COUNTY

Dr. CHAMBERS. My name is Leslie A. Chambers and I am presently director of research for the Air Pollution Control District of the County of Los Angeles. Prior to my very recent transfer—actually about 4 weeks ago—to Los Angeles, I was Director of Research at the Robert A. Taft Sanitary Engineering Center of the United States Public Health Service in Cincinnati, Ohio. In that position I directed the research and development activities of the Public Health Service programs in environmental sanitation, including air pollution.

This Los Angeles smog problem comprises a complex maze of interacting factors. After the testimony that you listened to, I think it is unnecessary to reiterate that. There are meteorologic, topographic, industrial, demographic, agricultural, commercial, and transport related factors. While the problem in this area has become acute sooner than in most other metropolitan centers or any other metropolitan center of the United States, none of the elements known to be contributing to it here are unique. In fact, there is slowly accumulating evidence that other cities are beginning to experience some of the same eye-smarting, plant-damaging air pollution that is currently associated in the public mind with Los Angeles.

That Los Angeles became the first city to suffer so acutely from smog conditions has been attributed to our peculiar local meteorologic conditions reenforced by a basinlike topography. On about 200 days each year a weather condition known technically as a temperature inversion is present over this area. This means simply that a layer of air warmer than that of ground level clamps down tightly over the Los Angeles basin, preventing dissipation of air-contaminating materials. On about 100 days a year this inversion layer is low enough so that concentration of the contaminants results. Under such conditions, Los Angeles suffers from smog.

Now, since the weather is up to this date beyond our control, we are faced with the research problems of identifying the substances present in the atmosphere during smoggy periods, and of determining which of them are responsible for the trouble, and how and where they originate.

In any community of 5 million people the kinds of pollutants thrown into the air exist in some multiple of the kinds of domestic and industrial and commercial transport and other activities necessary to the survival of the population and the maintenance of the total economy. In addition, the contributions of desert dust, water vapor, windblown

topsoil, and other natural phenomena complicate the picture. Some of the major sources of pollution have been recognized and steps taken to control these in Los Angeles have gone far beyond those taken so far in any other part of the country.

The exact substances producing the eye irritation and plant damage have not yet been identified. However, the very substantial research already carried out has demonstrated that the irritant is associated, at least in part, with a series of reactions or combinations of pollutants in the atmosphere which can occur with the addition of energy derived from the sun. In the identified reacting mixture simple hydrocarbons, such as gasoline vapor and oxides of nitrogen, are the necessary culprits. It is therefore logical and necessary that immediate attention be paid to the development of methods for determining the presence of these substances, and for controlling their emission to the atmosphere. Hence, the very major emphasis of the air pollution control district's program on methods and devices for regulation of vapor losses from all phases of petroleum production, refining, distribution, and use, including automotive.

However, it must be understood that hydrocarbons and other organic substances capable of reacting in objectionable ways are produced from many other sources. The domestic and industrial incineration of refuse under improper conditions, volatilization of paints and paint sprays, many manufacturing industries, and possibly some natural processes, also contribute materials of this type.

Furthermore, and still more complicating, there is developing evidence that some of the dust and other fine particles may actually play a role in the kinds and rates of reactions which occur under the influence of the sun. Unfortunately, methods and some scientific theories for analysis of this complex system of reactions are largely unavailable and will have to be developed.

From the research point of view the immediate objectives of the district include the following:

(1) To determine the relative importance of the several contaminants which have been identified in the Los Angeles atmosphere, including particularly oxides of nitrogen and hydrocarbons. Research of this character should indicate to us the reduction in these materials which must be achieved in order to correct our smog problem substantially. The data are extremely important in order properly to evaluate and develop devices capable of controlling the emission of these contaminants from their several sources at the required levels.

(2) To establish and maintain an extensive program of air monitoring whereby we can isolate and measure the several contaminants in our atmosphere and to develop the analytical instrumentation necessary to make such a system effective. This is a pioneer area of activity which will be of great interest to other areas throughout the United States and the world.

(3) The third objective will be to identify any other significant air contaminants on a basis of an attempt at a total description of our reacting mess.

Our present control program is based only on what we know about smog. We do not delude ourselves into believing what we know includes all that should be known. We think we have reasonably sufficient evidence that hydrocarbons, certain organic compounds, oxides of nitrogen and oxides of sulfur and particulate matter and

aerosols of various types are contributors to smog and should be controlled. There may be other significant materials in the long summary of contaminants that have not yet been identified. This means that a more vigorous and comprehensive program must be continued at every level.

In addition to the very costly and difficult research program necessary to accomplish the control objectives of the district, there remains the more subtle and equally important question of the effects of smog on the health of people obliged to live in it. I shall defer to more competent witnesses in reference to this area of research, but cannot refrain from placing on record my belief that the people of Los Angeles, while objecting to eye irritation per se, are really concerned about it as indicating the possibility of more permanently damaging effects on their health. The validity of this very natural response can only be determined by extensive and detailed accumulation and analysis of epidemiologic and medical evidence.

Many aspects of the total research requirement with respect to the smog problem will require marshaling of the best brains of the country and the participation of all levels of government. We are dealing basically with an effort to establish and to maintain a tolerable quality level in what must be regarded as a limited amount of air available to us.

Mr. ROOSEVELT. Mr. Chambers, before we let you go, there are a couple of questions which I would like to ask because I think you are particularly able to answer them.

Because of your experience with the United States Public Health Service, would it be your recommendation to this committee that Federal funds be allocated directly to the control district and particularly to your department—I am talking now about research funds—in order that you should be able to coordinate these funds to the best possible service and with the least possible redtape and to get them into the most productive channels?

Dr. CHAMBERS. In answer to your question, sir, I find myself in a little bit of an awkward position because a month ago I was participating in discussions of policy regarding this particular thing from the other side of the fence.

Mr. ROOSEVELT. That is exactly why I asked it. I want to know the other side of the fence.

Dr. CHAMBERS. There are, as you know, under Public Law 159 provisions for research grants to governmental activities of the type we have in the district. There have, as a matter of fact, under the current fiscal year's appropriation, been assigned through the State health department to the district two men who are Public Health Service officers actually working on projects in the district. This is one procedure by which some help has been given and more could be. Second, it would be possible to contract, for the Federal Government to contract, for research with the district organization. Third, it would be conceivable that the Public Health Service could establish a unit jointly with the Weather Bureau and the Bureau of Mines and the Bureau of Standards with whom they are cooperating closely on development of the air-pollution problem, a unit taking over certain phases of research activity in this area which could be integrated in one way or another administratively with the district operation. As a matter of fact, I think it is probably generally known that

I have been retained in a nominal capacity as consultant to the Public Health Service in expectation that the development of this program would result in my availability from both sides of the picture to tie the thing together here in Los Angeles. I think we can anticipate, and I don't believe I am going out on a limb policywise, I think we can anticipate that there will be some form of added contribution through the Public Health Service to this local effort during the next fiscal year. A lot will depend on what the Senate does to the present budget.

Mr. ROOSEVELT. Is this a matter of appropriation or a matter of additional authority, legal authority or legislative authority granted to the Department?

Dr. CHAMBERS. I think, sir, it is largely a matter of appropriation. The authority exists, as I understand it.

Mr. ROOSEVELT. In other words, if the amount of money can be restored, this cooperation and coordination can take place under existing statutes?

Dr. CHAMBERS. That is my understanding, sir.

Mr. SHEEHAN. Mr. Roosevelt, I think when the conference report comes back from the Senate all the Members ought to get together and object to the conference report.

Mr. ROOSEVELT. I think you may have something. I hope we can enlist two other Members of Illinois and Oklahoma at the same time.

Mr. PRICHARD. I would like to ask 1 or 2 questions.

Dr. CHAMBERS. Yes, sir.

Mr. PRICHARD. Dr. Chambers, you listed nitrous oxide as one of the——

Dr. CHAMBERS. I beg your pardon. I think I said oxide of nitrogen. There are several of those.

Mr. PRICHARD. All right. I will stand corrected, although I think what I said is the equivalent.

Is there any control at the present time regarding the oxides of nitrogen?

Dr. CHAMBERS. Is there any control being used in the district, you mean?

Mr. PRICHARD. That is right.

Dr. CHAMBERS. None that I am aware of, sir, except from the standpoint of the very general attempt at control of unnecessary types of combustion, such as backyard incinerators and single chamber incinerators. Oxides of nitrogen are produced in almost every combustion process, so any reduction of unnecessary combustion assists, but there is no specific control, I would say.

Mr. PRICHARD. And at the present time there is no control over the pollutants cast into the air by automobiles; is that right?

Dr. CHAMBERS. That is, there are none being used at the present time.

Mr. PRICHARD. That is what I am referring to. Can you give us any idea as to what is the portion or proportion of the total pollution that is thus uncontrolled?

Dr. CHAMBERS. The total in O_2, oxides of nitrogen or the total hydrocarbons or the total of everything?

Mr. PRICHARD. I am not talking about the total of those, but the total proportion. There has been testimony here, Dr. Chambers, that

the automobile has cast into the air 40 percent of the total pollutants, others say 50 and others say 60 percent.

Now, I don't know myself what they cast, but if the automobile casts 40 percent, what total percentage of the total of pollutants is at the present moment not under control at all?

Dr. CHAMBERS. I think this is a concept that I would hesitate to hazard a guess upon, sir; a percentage of an unknown quantity. I would point out that on occasions that the wind blows in here from the desert and we get a tremendous load of particulate matter from the desert dust and so on. All of this is part of the total load, but I think what we are concerning ourselves here with will be the local contributions primarily. If we have to get a percentage of the total pollution load at any given time, we would have to prescribe the time, in other words, which way the wind is blowing from.

Mr. PRICHARD. The answer is either you don't want or you can't answer it; which is it?

Dr. CHAMBERS. The answer is that I think the question is based on a hypothesis that is faulty. I will answer it another way, sir. There are figures on the tonnages of emissions on a daily basis from automotive vehicles, from various types of industries; and those figures are available.

Mr. PRICHARD. Do you have those available?

Dr. CHAMBERS. They are available. I don't have them with me. Do you have them here, sir? Thank you.

This little piece of payer shows that from automobile exhaust——

Mr. PRICHARD. As of what date is this?

Dr. CHAMBERS. This is March 1, 1956. Automobile exhausts, diesel trucks, fuel-oil burning, natural-gas burning, petroleum production, petroleum refining, petroleum marketing, sulfur recovery plants, domestic incinerators, municipal incinerators, other types of incinerations, coatings and solvents, nonferrous metals, ferrous metals, minerals and food processing. All of these are listed in terms of their contribution of aldehydes, aerosols, oxides of nitrogen, oxides of sulfur, hydrocarbons, organic acids in tons per day. I think this may be an item that will be of use in the record.

Mr. ROOSEVELT. We will enter it into the record and have it printed and we will submit it without objection.

(The matter referred to follows:)

AIR POLLUTION CONTROL DISTRICT, EVALUATION AND PLANNING STAFF, MARCH 1, 1956

Rule 156 (Reg. VII)

Alert stages for toxic air pollutants

[In parts per million]

	1st alert	2d alert	3d alert
Carbon monoxide	100	200	300
Nitrogen oxides	.3	5	10
Sulfur oxides	3	5	10
Ozone	.5	1.0	1.5

Maximum concentration of pollutants measured in Los Angeles County

	Concentration	Station	Date
	P. p. m.		
Carbon monoxide	99	West Los Angeles	Oct. 29, 1955
Nitrogen oxides	1.74	Central Los Angeles	Sept. 17, 1953
Sulfur dioxide	1.7	El Segundo	May 18, 1955
Ozone	.9	Vernon	Sept. 13, 1955
	Mg/1,000 m³		
Silicon	75.6	Central Los Angeles	Nov. 13, 1951
Magnesium	6.2	do	Nov. 29, 1951
Calcium	16.8	do	do
Aluminum	16.8	do	Nov. 2, 1953
Iron	19.6	do	Sept. 15, 1951
Copper	1.1	do	Sept. 11, 1953
Lead	42.4	do	Oct. 10, 1950

Air monitoring stations

1. Central Los Angeles
2. West Los Angeles
3. Highland Park
4. Pasadena
5. Rivera
6. Bassett
7. Azusa
8. Walnut
9. Burbank
10. Sylmar
11. Reseda
12. Lennox
13. Torrance
14. Artesia [1]
15. Vernon

[1] Inoperative.

AIR POLLUTION CONTROL DISTRICT, EVALUATION AND PLANNING STAFF, MARCH 1, 1956

Emissions to the atmosphere in tons per day

Aldehydes	150	SO_2	675
Aerosols	240	Hydrocarbons	1,647
NO_2	1,120	Organic acids	25

Source	Aldehydes	Aerosols	Nitrogen oxides	Sulfur dioxide	Hydrocarbons	Organic acids
Automobile	133	30	770	36	1,090	13
Diesel trucks	.4	1.6	2.7	.8	(2)	.8
Fuel oil burning	5.5	33	218	425	1.7	3.3
Natural gas burning	8.5	3.6	107	.7	(2)	2.4
Petroleum production	0	0	0	0	[1] 40	0
Petroleum refining	0	[1] 4	0	170	193	0
Petroleum marketing	(2)	0	(2)	0	85	0
Sulfur recovery plants	0	0	0	33	0	0
Incineration, domestic	3	41	8	5.6	(2)	5.3
Incineration, municipal	(3)	6.4	5	(3)	(3)	(3)
Incineration—other	(3)	[1] 93	8	(3)	(3)	(3)
Coatings and solvents	(3)	(3)	(3)	0	[1] 237	(3)
Nonferrous metals	(3)	[1] 6	(3)	(3)	(3)	(3)
Ferrous metals	(3)	1	(3)	(3)	(3)	(3)
Minerals	(3)	20	0	0	2.7	0
Food	(3)	1	(3)	(3)	(3)	(3)

[1] Estimated. [2] Negligible. [3] Unknown.

Dr. CHAMBERS. These are the best estimates to date of our planning and evaluation staff, one of whose fuctions is to maintain a running inventory literally——

Mr. ROOSEVELT. Of that total tonnage, how much is controlled to any degree and how much is completely uncontrolled?

Dr. CHAMBERS. Can I defer that? I have been here 4 weeks. Can I defer that question?

Mr. GRISWOLD. Oxides of nitrogen, there is no percentage control as of the present time. I believe that when the incinerator ban goes into effect in October of 1957, why, that portion of it there that you see opposite incinerators will be to a degree controlled, to a large de-

gree. Now, at the present time there is some very important research on the control of oxides of nitrogen and the part that they play in our air-pollution problem being done in connection with a complete reevaluation and development of industrial controls on steam powerplants burning fuel oil. I think the same thing would apply to steam powerplants burning coal, which are also great producers of oxides of nitrogen.

Mr. ROOSEVELT. As of now neither of those are being controlled?

Mr. GRISWOLD. Neither are being controlled. Now, if I could interest you in hearing from our engineer, he will cover each one of these in a fairly short paragraph, each one of the industries for you, ferrous, nonferrous, steam powerplants, the entire field in a fairly shore period of time.

Mr. PRICHARD. I am not trying to be critical, understand; I am trying to develop the fact, and maybe we can get it simply in summation, that despite the best efforts of the district there is still a tremendous problem before you.

Mr. GRISWOLD. It is absolutely staggering. After we finish this, we will probably have radioactive dust, and as technology increases, why, we are going to have more complex, more complicating problems that will probably make those that we have today and are struggling with fairly small.

Mr. PRICHARD. I think that answers exactly what I wanted to know.

May we have this for the record, however?

Dr. CHAMBERS. Yes.

Mr. ROOSEVELT. Mr. Sheehan had another question.

Mr. SHEEHAN. Dr. Chambers, Mr. Griswold said something about your department had not solved the problem at all so far and you are going to be the director of research, so you are going to have the big problem to solve. You stated, as I remember, that the exact substances that are producing these irritations are still unknown.

Dr. CHAMBERS. That's correct.

Mr. SHEEHAN. Now, we tried to find out yesterday from some of the mechanical men that were here if they would hazard a guess. My question is, would you hazard a guess. Now surely, it has to be quite a guess. I realize that. I can't tie you down to a specific date, but on the basis of your past experience with the Public Health Service and what you know of the problem in 4 weeks, would you say the residents here are going to look forward to some degree of stopping of the smog or the smog irritations, or you will have a fairly decent degree of smog control in what period in the future?

Dr. CHAMBERS. I can answer that purely on a conjectural basis.

Mr. SHEEHAN. Yes; it is an estimate.

Dr. CHAMBERS. My prediction would be, and this is a personal prediction based, as you indicated, on skimpy evidence so far, my prediction would be that as soon as the ban on single chamber incinerators becomes genuinely effective and as soon as——

Mr. ROOSEVELT. Do you want to speak a little louder. I think they are having trouble hearing you.

Dr. CHAMBERS. As soon as the ban on single chamber incinerators becomes genuinely effective and as soon as even a partial suppression, say, of hydrocarbons from automotive exhausts, then there will be a period of respite from really acute damage. There will be a reduc-

tion in the eye irritation. This is my prediction. However, we can't lose sight of the fact, and as the evidence has brought this out, I think, time after time, that we are in an explosive population growth space, and that we will not by any single action of this sort hold the line for very long. The fact is we are dealing with about 800 to 1,000 cubic miles of air here available to us. Every man we introduce is producing, even if he sits still, a certain contamination of that atmosphere. Every time he moves he is producing more, and every time he has to use anything produced in that atmosphere he is requiring still more. So, from here on out in the case of air, as in the case of water supplies, water pollution, we are dealing with an exactly analogous situation. It is a limited supply in which we have got to maintain a quality that is tolerable to the population that is going to have to use it man for man. This means that the quality level will have to be improved progressively in terms of admissible outputs per individual or per factory or whatnot as the population becomes more concentrated. There seems no way to beat that.

Mr. SHEEHAN. In other words, October of 1957 is sort of a target date, as I understand it, for the banning of incinerators so the second phase of your partial remedy would be when the authority here decides to do something or can do something definitely on the gasoline.

Dr. CHAMBERS. I think you are right. The decision to do it has been done. When it is available it will be done.

Mr. SHEEHAN. I might say, Dr. Chambers, in talking with Mr. Roosevelt at lunch we all seemed to be of the opinion exactly as you stated it, that although you may solve this particular problem this month or this year, nobody knows what next year is going to bring and you might run into entirely different problems.

Dr. CHAMBERS. Qualitatively, the problem could change overnight because of technical changes; right.

Mr. ROOSEVELT. In the matter of automobile devices, are you in direct contact with the committee in Detroit in the automobile industry? Am I asking the wrong person?

Mr. GRISWOLD. I have Mr. Linville here.

Mr. ROOSEVELT. All right. I will defer that question.

Mr. Biscailuz, did you have any questions?

Mr. BISCAILUZ. I have no questions.

Mr. ROOSEVELT. I have one more question. You know what is available from the Public Health Service. You know that the present bill was reduced from $3 million by approximately, I believe——

Dr. CHAMBERS. 265.

Mr. ROOSEVELT. $265,000.

Dr. CHAMBERS. Yes.

Mr. ROOSEVELT. What do you consider you could usefully use as an allocation of funds from the Federal Government to the control district in your work?

Dr. CHAMBERS. Well, this is an awkward question to have to answer from my vantage point, sir.

Mr. ROOSEVELT. Yes, I know, but it is important.

Dr. CHAMBERS. In the first place, it is a matter that has been discussed on the other side of the fence, and in the second place, I doubt that I have developed a program here in sufficient detail to be able to pin it down very exactly, but I would suggest——

Mr. ROOSEVELT. About when will you be able to do it?

Dr. CHAMBERS. I will do it right now, if you understand this is a highly preliminary type of thing. My guess is that in a single fiscal year, starting in July, and assuming that our possibility of recruitment of a staff goes along as well as it has in the last 4 weeks, I would guess that we could use effectively in this area about half a million dollars, that is, in the research application only. I am not talking now about any support for enforcement or engineering developments.

Mr. ROOSEVELT. I will ask Mr. Griswold at a later time for a summation of all of the funds that he thinks could usefully be used. Obviously our interest is to try to secure what can usefully be used and no more, because public funds need to be properly regulated.

Dr. CHAMBERS. I should add, sir, on a long-term basis probably a program could be developed which could be on a sliding-matching funds operation. I would suggest not $500,000 for the next fiscal year, in which the time is short and there would be the difficulty of getting——

Mr. ROOSEVELT. Again, perhaps I should address this question to Mr. Griswold. In fact, I will, because I think it is fairer.

Does the district have a long-range program in mind which it can present to the Federal Government for a partnership arrangement? In other words, we have outlined here a long-range problem which isn't going to be over this year or probably for the foreseeable future. Have you a program, let us say, that would cover 5 years in prospect which can be presented to the proper committees of the Congress?

Mr. GRISWOLD. The air pollution control district over the past 6 months to a year has been developing, with the aid of the consultants, one of whom has testified before your committee, Dr. Haagen-Smit; Dr. Bray, of Bray Chemical; Dr. Blacet, dean of the school of chemical engineering and chemistry at UCLA, both a long-range and a short-range research program. We have appropriated in the next year's budget $705,000 for what we call basic or ivory tower research. We felt that the Federal Government should match those funds. Those funds are for research on projects which we feel would be of national interest; development of instruments which will save tedious laboratory processes, instrumentation, which in its exactitude would measure a fraction of a part of a contaminant in a million parts of air; work in connection with oxides of nitrogen under general district supervision at the California Institute of Technology. There are some highly qualified men over there that are not being used in connection with this air-pollution problem. They live here, they are where the concentrations are highest and we sincerely feel that this is where the work should be done, not only because—it is just as you would establish Taft Engineering Center on the Ohio River where you have the greatest water pollution problem and expect to utilize benefits from the work done there elsewhere in water pollution in the United States, I feel that the Federal Government in its activity might reasonably work here, because I think we are always, because of this meteorology and physiography, going to have the most critical air-pollution problem of any metropolitan area and have it first. The others will get it but they won't get it except under the delayed reaction. So the answer is "Yes."

Mr. ROOSEVELT. Now, then, of course, there are other fields, such as the research into the health problem or the effect of this on health.

Mr. GRISWOLD. There is one thing we might clarify in connection with the health aspects of air pollution as against the environmental

or so-called engineering aspects of air pollution and its control. The Los Angeles County Air Pollution Control District was primarily concerned with engineering phases and the board of supervisors continued this emphasis on doing something to eliminate pollutants that went into the air during the entire life of the district up until very recent years, that is, about 2 years ago. They did that on the basis that whether it damages your health or no one likes it, we want to get rid of it. I think that is the general consensus of opinion around here, although I want to make it very plain now that I think research into the health aspects of air pollution are very important. I think we are going to have, because of contaminants in the air, particularly in urban areas, we are going to have this problem with us for a good long time to come, so we might as well find out as quickly as possible just exactly how which contaminants affect the public health.

Mr. ROOSEVELT. Would you prefer, however, that the control district should not have that responsibility, but that it should be done between, let's say, the Department of Public Health on the State level and the Federal Department?

Mr. GRISWOLD. With the passage of Public Law 159 establishing the Federal Air Pollution Control Agency and with the establishment of the Bureau of Air Sanitation of the Department of Public Health, both in public health activities, representatives of all of the groups met in Berkeley. There we went over—between the United States Public Health, the California State Department of Public Health, and our activity, we went over areas of jurisdiction where we felt that each institution or organization could do the most in the most expeditious manner without duplicating something that was being done elsewhere. Now at that conference it was decided that the major portion of the State public health activity, because it was in a health department and because there were doctors who were industrial hygienists and toxicologists, that they would together with the United States Public Health Service, take over the effects of air pollution on public health as a prime responsibility. Now, for that reason we have not gone into that except in the selection of a director of research which we took a plenty long time to do, over a year, and the fact that he was thoroughly acquainted with public health, had experience at the University of Pennsylvania School of Medicine for some 14 years, that he should be brought in here so that if it became necessary in the protection of this public health and welfare of the people here and we had to get into it, why, it would be properly supervised and correlated.

Mr. ROOSEVELT. Then at the moment——

Mr. GRISWOLD. At the moment we are not in.

Mr. ROOSEVELT. The State Department of Public Health has the prime responsibility in your opinion?

Mr. GRISWOLD. Yes, and the United States Public Health Service.

Mr. ROOSEVELT. In cooperation with the United States Public Health Service.

Mr. GRISWOLD. As I say, we have no medical research in connection with this, with one possible exception, you might call it, the scientific committee of the air pollution control district made up of 15 leading industrial hygienists and toxicologists in this area, headed by Dr. McPhearson of the School of Medical Evangelists who meet regularly to consult with the district and myself as air pollution control officer in the calling of alerts in the interest of protecting the public health

and welfare. Now, they advise us as to what concentrations a contaminant will have to reach before it becomes either a preliminary, a secondary, or a critical health hazard.

Mr. PRICHARD. May I interpose a question just to clarify the record. As I understand it then, Mr. Griswold, both the budget proposed and the budget that you referred to, the $700,000 figure, neither one of them includes any health research.

Mr. GRISWOLD. No, it does not. It includes work in connection with several projects which would be considered within the sanitary engineering phases of it.

Mr. ROOSEVELT. However, is it not true that that conference at Berkeley did set up the specific amounts of money for the projects which could be put into immediate use?

Mr. GRISWOLD. A later conference, Congressman, the one that just was completed fairly recently. The one I am referring to is the one that was held describing areas of activity, just a little over a year ago.

Mr. ROOSEVELT. But the later conference did set up the specific amount of medical or health research fund that could be usefully applied at this time?

Mr. GRISWOLD. Yes.

Dr. CHAMBERS. In both of the two areas, the environmental and medical.

Mr. PRICHARD. The $700,000 includes both; is that right?

Dr. CHAMBER. No, sir. Those are two different things in that case, two different documents.

Mr. GRISWOLD. $750,000 is for engineering research, developing controls——

Mr. ROOSEVELT. Basic or ivory-tower research.

Mr. GRISWOLD. Contaminants, development of instrumentation, all that sore of thing.

Dr. CHAMBERS. I resent the ivory-tower basis. [Laughter.]

I would like to point out that the one thing that has been identified out here as related to this hydrocarbon and oxide of nitrogen, ozone, sunlight proposition, and that is, as a matter of fact, the only scientific contribution that is really unique and outstanding, that has made it possible to move, and that came out of an ivory tower right here in this area.

Mr. ROOSEVELT. Well, thank you very much, Dr. Chambers.

Mr. GRISWOLD. I would like to ask Mr. Crabaugh, chief engineer of the district, to briefly describe what is being done industry by industry, large categories of industry.

Mr. ROOSEVELT. Mr. Crabaugh, we are happy to have you with us. Just give your full name to the reporter so that we may have it.

Mr. CRABAUGH. Hoyt R. Crabaugh, director of engineering of the district.

TESTIMONY OF HOYT R. CRABAUGH, DIRECTOR OF ENGINEERING, LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT

Mr. CRABAUGH. As has been explained in previous testimony, the solution to the smog problem in Los Angeles and in other urban areas involves a three-prong program: First, research to identify the contaminants which create smog and the sources from which they are emitted; second, the development and installation of control mecha-

nisms, practices, or techniques at the many sources of their emission; and third, continuing inspections and enforcement activities to identify new sources and to insure the proper and continued operation of basic and control equipment within the limits prescribed by law.

I should like to discuss briefly that portion of the district's program which is concerned with the development and installation of source controls suitable for preventing the emission of air pollutants, air contaminants.

In order to control any given source it is necessary, first, that the specific contaminants emitted by that source be completely and accurately identified; second, that we know the characteristics of the gaseous medium conveying the pollutants into the atmosphere; and third, that we know the chemical and physical characteristics of the pollutants involved.

In order to acquire this information, we must rely on competent researchers to develop test procedures and equipment suitable for analyzing source emissions, and we must organize source testing teams composed of trained engineers, chemists, and other technicians. This one facet of the engineering control program alone has constituted a substantial portion of our total research effort.

Once we have acquired reliable data regarding source emissions, it is then possible to make engineering studies and to pursue other activities aimed in the development of suitable control methods and equipment. In view of the extensive program conducted by this agency, and in view of the high degree of control efficiency we require on all sources, we have been fortunate in accomplishing some rather unique and important engineering "firsts" in the field of air pollution control. Some of these accomplishments include the following:

1. The control of dust and fumes from gray iron cupolas, direct arc electric steel melting furnaces and open hearth steel melting furnaces. All of these sources in Los Angeles County have been controlled by the use of well designed cloth baghouses or electrical precipitators. Control efficiencies normally exceed 95 percent and in many cases approach 100 percent. These controls were the first of their kind installed anywhere in the world on these particular operations.

2. Hydrocarbon vapor recovery systems. These systems ranging in control efficiency from 85 to 100 percent include floating roof tanks, vapor spheres, and vapor compression and absorption systems. Approximately 600 tons per day of hydrocarbon are presently being controlled by these facilities.

3. Sulfur recovery plants. The first plant in the United States which was specifically designed to convert hydrogen sulfide to sulfur was installed in Los Angeles County. As of this date the sulfur dioxide recovered by scavenger plants and not emitted into the atmosphere amounts to over 800 tons per day. Construction is now in progress to increase the capacity of sulfur recovery and sulfuric-acid plants to further reduce the emissions of sulfur dioxide from refineries and other sources.

4. Improvements in incineration processes. Rapid advancement in the design of multiple-chamber incinerators over the last 8 years has resulted in operating units which are capable of reducing the ash and organic discharge to approximately one-tenth of that from industrial and domestic single-chamber incinerators. Further improvements are being made daily in municipal incinerator design.

5. Control of asphalt roofing saturator plants. This control has been effected by the use of highly efficient water scrubbers or by combination water scrubbers and electrical precipitators with efficiencies ranging from 85 to 95 percent.

6. Control of hot asphalt plants. The control of dust and fumes from hot asphalt plants by the use of combination cyclones and water scrubbers has resulted in an effective reduction of from 95 to over 99 percent in the dusts formerly discharged to the atmosphere.

Through the activities of the types mentioned, we have been able to prevent more than 1,500 tons of air-contaminating materials from entering our atmosphere each day.

Mr. ROOSEVELT. Have you any idea how much of a reduction it was, what it was before these went into effect?

Mr. GRISWOLD. Of the 1,500 tons?

Mr. ROOSEVELT. Yes.

Mr. GRISWOLD. I think that could be answered by saying that it is possible to estimate what it would have been based on the output of the individual type of plant, considering the total amount of production from that classification, and we estimate that it would be in the vicinity of 5,600 tons per that would go into the air in this area. Now it is down to where we consider it about 3,000, of which the largest is, again, auto exhaust of that 3,400 tons that still goes into the air.

Mr. CRABAUGH. Our engineering developmental program, however, it a continuing and expanding portion of the district's total effort. As research identifies new contaminants and important sources, it becomes necessary for us to develop or stimulate the development of further control methods and equipment.

Mr. ROOSEVELT. Could I interrupt you again before you get off that point? If today we had 5,600 tons going into the air, would we have an almost impossible situation?

Mr. GRISWOLD. We certainly would. A large part of that would be sulfur, with sulfur dioxide and dust, which would constitute, with our inversion layer, an almost impossible living condition.

Mr. ROOSEVELT. Thank you.

Mr. CRABAUGH. In the terms mentioned, some projects now underway in the district include:

1. Auto exhaust controls. In addition to the work being done by the automobile manufacturers and private firms to control hydrocarbons from auto exhausts, the district has established its own automotive testing laboratory. The work of our staff assigned to this facility includes both the testing of auto exhaust control devices and basic research involved in the development of more efficient devices.

2. Service station controls. In order to expedite the development of service station controls, our own technicians designed and installed and have tested an extremely effective control device. Regulations are presently being formulated to control the hydrocarbon emissions during the filling of underground tanks at service stations. Further research is underway to determine means of controlling gasoline vapor losses from the filling of automobile tanks at service stations.

Mr. ROOSEVELT. Mr. Crabaugh, on both of these points, number one, do you have available to you the work of the Detroit committee that you referred to, the automobile committee?

Mr. CRABAUGH. Yes, sir.

Mr. ROOSEVELT. All of their results are available to you so that they may be coordinated with the work that you do on your own?

Mr. CRABAUGH. I believe so. This work comes under Mr. Wallace Lindville, our director.

Mr. GRISWOLD. The answer to that is that at the present time the industry has some of their finest equipment out here. The vehicle products subcommittee of the Automobile Manufacturers Association, we are jointly running tests to determine what the average driving conditions are in this basin, which is a traffic analysis to determine the total quantities of emissions under driving conditions in this area. It is basic data on which they hope to determine the efficiency, the maximum efficiency of the device they hope to develop, to see whether a device that will eliminate 50 percent of the hydrocarbons will do an appreciable amount of good.

Mr. ROOSEVELT. May I ask you, Mr. Griswold, if it isn't embarrassing for you to answer it, do you know of your own knowledge how close the industry is to such a development? In other words, one of the witnesses before the committee said he felt sure that one had already been developed. Others said that it was a dream that still had not materialized. Can you give us any information on that?

Mr. GRISWOLD. I believe that the industry—in fact, I saw sitting at a table like this 40 devices which were under test at the General Motors Research Laboratories. The one thing that the industry is concerned about in any device that it puts on an automobile is that it in no way affects the performance of that car. In other words, it can't stall at a stop sign. It can't lose any of its acceleration, I mean, and they are going to be most concerned with that. "Why," they say, very frankly, "we only sell 5 percent of our total production in the Los Angeles basin and we know that you have to have automobiles here because of the fact that your transportation system is based on the freeway system and on adequate highways," which we have always had here, "and that the public here demands more automobiles and needs more automobiles, more than the same percentage elsewhere."

Mr. ROOSEVELT. Might not that very fact make them, knowing that we have to buy automobiles anyway, might not that make them say, "Well, we don't care whether we develop it or not; we'll take our own jolly good time about it."

Mr. GRISWOLD. I would say that is exactly true. They will come out with a device which, when they are completely satisfied, after the most rigorous testing and after the most detailed research, they will come out with a device which will be put on new cars at the plant. Before that time they will probably come to the county board of supervisors here any say, "Here is a device that will do X, eliminate X amount of exhaust, will cost X dollars. Take it or leave it." That is one of the reasons why the district has set up this combusion laboratory which we have, because we are now engaged and have been for a year in testing devices developed by the Holly Carburetor Manufacturing Co. and by Fagil Bus, which was the old Swing Coast Co.—you have heard the names, know of their trucks—and there are several other large industrial agencies which are interested in developing an exhaust control or carburetor control device. In fact, we recently had a showing while the industry representatives were still here about 2 weeks ago of some 8 devices which we consider have a definite potential. But there again it is very necessary that you know exactly

what these devices will do, and that you have a basic knowledge of what effect they will have on the smog situation before you ask the owners of 2,700,00 automobiles to install them.

Mr. ROOSEVELT. Is there any role in which the Bureau of Standards or the Bureau of Mines might play in this development?

Mr. GRISWOLD. That would entirely depend upon the personnel that they had and that which they felt that they could allocate to this project. There is one thing that has struck me as being most important in connection with technical men in the field of air pollution and its control. It is so new compared to water pollution or something else that there are a very limited number of people throughout the United States. We thank the Lord we have a lion's share of them. Everyone comes here to hire men. When we had men assigned here, say from the Federal Government, which was a very cooperative gesture, they were good engineers but it took them a year to become oriented on this problem in connection with this work, in order to develop maximum efficiency, which they have now.

Mr. ROOSEVELT. What I am trying to get at is that admittedly the automobile industry is in no hurry to produce this device. Therefore, you have set up your agency through which you hope to speed it up. Can you speed it up if you can secure matching funds or additional funds?

Mr. GRISWOLD. I believe that if the Federal Government, either through its Bureau of Standards or through its Bureau of Mines, would interest itself in not only a study of an adequate exhaust control device, but for automobiles, either on the intake manifold side or the exhaust, and also in fuels developed as used by automobiles and to be used by automobiles, say when we have turbine engines or fuel injection carburetion, it would be one of the best things that they could do.

Mr. ROOSEVELT. Thank you, sir.

Mr. CRABAUGH. Further research is underway to determine the means of controlling the hydrocarbon vapor losses from the filling of automobile tanks at service stations.

3. Steam powerplant controls. Due to the extremely rapid growth of both population and industry in Los Angeles County and the continuing decrease in hydroelectric power being received in this area, there has been a large increase in the number of steam power generating plants with resultant increases in air contaminants from such plants when burning fuel oil. Research studies are well underway to determine the types and extent of air contaminants emitted including sulfur dioxide, oxides of nitrogen and finely divided ash particles and pilot plant installations have already been completed to control the particulate matter emissions from these operations. Further engineering studies are also underway to determine means of controlling sulfur dioxide and oxides of nitrogen.

4. Control of solvent losses from paint baking ovens, solvent processing operations and other similar sources. This project is well underway. Several combustion devices are already in use to minimize organic contaminants from sources of these kinds. Current engineering studies are also being made to determine the feasibility of activated charcoal absorption systems.

5. In addition to the above projects, the district engineers and technicians are continuously engaged in research aimed at increasing

control efficiencies for all sources of air contaminants should this prove to be necessary.

As you might imagine, we feel very strongly that engineering activities of the types mentioned not only offer great hope for controlling the problem here in Los Angeles but also the problems faced in many other metropolitan areas throughout the Nation.

Mr. ROOSEVELT. Thank you, Mr. Crabaugh. Any further questions?

Mr. GRISWOLD. Incidentally, in connection with one phase of that I might mention that one of the large private power industries or power activities here, Southern California Edison Co., was interested in securing operating permits for its large El Segundo plant and also in securing permits to construct 7 additional units—about 6 additional units. Well, it was estimated that not only the total quantity of contaminants from the El Segundo plant, but that the additional six plants built along the same design as the one that had been constructed would constitute not immediately but well into the near future a source of contaminants which this air could not absorb. As a result of that, in going a little bit further the bureau of water and power engineers and consultants teamed up with Southern California Edison Co. consultants with district engineers, and are now working on methods, several methods: either taking the sulfur out of the fuel oil before it is burned, acquiring greater supplies of natural gas, or of one of several methods of precipitating the sulfur from the gaseous emission. The progress on that is very outstanding. There, when that project is done, completed here locally, it will be available for Chicago, which has a big problem in connection with that, and New York and other areas, but the research and the development on all of that work will be done here because it is a larger source of contamination than this area can stand. Now, it is in that type of work which I feel is of general benefit to the entire Nation which the people of Los Angeles have over a period of 8 years been carrying almost alone the complete burden up until most recently.

Mr. ROOSEVELT. Mr. Prichard, did you have any questions?

Mr. PRICHARD. No.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. No questions.

Mr. ROOSEVELT. Thank you very kindly. We appreciate your coming.

Mr. GRISWOLD. We are at your disposal. I should like to introduce Captain Fuller, director of enforcement; and Mr. Lindville is head of our auto combustion laboratory. Now, if you would like to discuss our enforcement program, whether you think it is adequate, whether you think we are carrying on a good one or not, or want to know any details in connection with exhaust control devices, what the industry is doing, what we are doing, we shall be glad to provide it.

Mr. ROOSEVELT. Thank you. I think we would have a few questions along that line. One of the first questions I would like to ask relates to the fact that you have said that in the question of enforcement that you are constantly on the alert to see those who are violating the existing regulations. The committee was given some information to indicate that there are in the petroleum industry violations which are not, let's say, cracked down on, whereas the impression has been given that the small fellow, while the numbers have increased, that they are little people and they are not big people, and the effort for control does

not really go to the biggest violators, and very frankly we would like to get your comment on the record on that subject.

Mr. GRISWOLD. Go ahead, Captain.

Mr. ROOSEVELT. Let me put it this way: Do you have from day to day or can you have a record of what is emitted into the air so that you can say that you have pretty good control over it on a day-to-day basis or week-to-week basis or any given period so that you know where the violations exist or upon what method do you rely to know where these violations are taking place?

Mr. FULLER. For the purpose of the record, my name is Louis J. Fuller, director of enforcement, air pollution control district.

TESTIMONY OF LOUIS J. FULLER, DIRECTOR OF ENFORCEMENT, AIR POLLUTION CONTROL DISTRICT, LOS ANGELES, CALIF.

Mr. FULLER. We do not have day-to-day records of emissions per se at any one locality, because we have in the field 24 hours per day inspectors in 3 functional categories: the patrol unit, which is the uniform black and white radio control car, the plant inspection unit, and the petrochemical and marine installation unit. There are 62 inspectors at the present time in the district. These men are graduates of an accredited college or university with degrees in engineering or chemistry, highly qualified. Under State law, they are peace officers for the purpose of enforcing the provisions of division 2, chapter 20, of the health and safety code. These men have increased the enforcement from an average of 7 prosecutions per month in the 7 years prior to my taking office to approximately 250 cases per month, which is some 3,800 percent increase, and the defendants in these criminal actions which I have prosecuted in this county have been financially able and have the legal resources to take their cases up through legal appeals to the appellate department of the superior court; to the superior court and to the United States Supreme Court.

I have occasionally seen statements to the effect that I have prosecuted nothing but housewives. For the record, this is not true. There have been no housewives prosecuted in my 17 months in office. I have prosecuted the major sources of air pollution in this county to the very best of my ability without reference to the identification of the violator, which makes no difference. I have prosecuted the largest sources of air pollution that exist in this county.

Mr. ROOSEVELT. What were they, for the record, Mr. Fuller?

Mr. FULLER. For the record, they are oil refineries—Bethlehem Steel, Dow Chemical, Southern California Edison Co.—all of the major sources of air pollution of that category—not once, but many times.

Mr. ROOSEVELT. Did those prosecutions result in convictions, and, if so, what were the sentences imposed?

Mr. FULLER. Well, of course, the sentences are controlled by the law here in this State. The maximum fine is $500, and, of course, you can't put the corporation in jail, so it has resulted in financial fines of—I think the total fines paid by the Southern California Edison Co. is about $800 in the last group.

Mr. ROOSEVELT. Well, now, Mr. Fuller, let me ask, you as a law-enforcement officer, is not the State law very definitely at fault when the maximum fine is $500 to a corporation that doesn't really care

whether it loses $500 at the time you get around to catching them at it, because there must be many times when you can't, and you can't be everywhere, and you may not be able to catch them? Wouldn't it be a help to you in enforcement if the State law perhaps fined them $10,000?

Mr. FULLER. If increased penalties would assist in the reduction of air pollution, I would certainly be for it.

Mr. ROOSEVELT. Would they?

Mr. FULLER. Well, I don't know. In some of these large companies that have national importance, whether a $10,000 fine would be much worse than $500, frankly, I don't know.

Mr. ROOSEVELT. $10,000 repeated over a period of time——

Mr. FULLER. Could be a considerable amount of money.

Mr. ROOSEVELT. You would agree it could be a deterrent?

Mr. FULLER. Yes; it would be.

Mr. ROOSEVELT. I call that to the attention of the State authorities to whom we shall send the record.

Mr. FULLER. With respect to other prosecutions, being attorneys, you gentlemen know that unless the sovereign is specifically indicated in restrictive legislation, then he is automatically exempted; but despite this absence in the health and safety code with respect to air pollution, I did proceed with the prosecutions of city officials and district officials in this county, because I felt then, and I feel now, that air pollution per se is just as noxious, regardless of who puts it out, and I think the controls should apply to every single person, every agency, whether it is public or private.

Mr. ROOSEVELT. In other words, the municipal plants by State law today are not subject to your control, and you feel they should be.

Mr. FULLER. Not only are they not subject but they are specifically exempt by a new section of the law which is presently in effect. I refer to section 24254 of the Health and Safety Code of the State of California.

Mr. ROOSEVELT. You feel strongly that that should be repealed?

Mr. FULLER. I certainly do. There is a very large, an extremely large area of air pollution. Thousands of installations, school districts, flood control, parks, city installations, powerplants, all of the various types of air pollution which may be caused by this type of operation, and I can do nothing about this. In addition to that, there are other exemptions and exceptions to the Health and Safety Code with respect to agricultural burning. These exemptions, for example, agriculture, state that the provisions of section 24242, which is excessive smoke, do not apply to agricultural operations in the growing of crops or the raising of fowls and animals.

Now, the law is being circumvented almost daily in this county by permits issued under the guise of agricultural operations, and there is an average of about a thousand trees per day over the year being burned in this county for the purpose of the expansion of homes, home building, et cetera.

It might be interesting to this committee to know that the total pollution which comes from the burning of just 1 acre is equivalent to the entire steel industry output uncontrolled in this county. So there again is a tremendous field of air pollution.

Mr. ROOSEVELT. Who issues those permits?

Mr. FULLER. Those permits are issued by the fire department, and I must say for the record that the fire departments have cooperated with the air-pollution control district generally to the best of their ability, but they are not in a position when a man comes in and asks for an agricultural permit to burn trees to go out and examine his operation to see whether it is agricultural.

Mr. ROOSEVELT. Why is it necessary to have the fire department have that jurisdiction? Would it not be better to give it to the control district, inasmuch as it is the agency to enforce the law?

Mr. FULLER. I think you would have a conflict there because of the peculiar duties of public officials, the fire department, whether the burning was necessary for the purpose of abating a fire hazard or something of that nature, and the law as it is presently written specifically provides that it is under the jurisdictional control of a public officer which is construed to be the fire department chief in a particular area.

Mr. ROOSEVELT. However, you have said this is being used to circumvent the law.

Mr. FULLER. Yes.

Mr. ROOSEVELT. I presume from that that there must be other ways of disposing of this fire hazard, and if that is so, would it not be possible for the State to write legislation which, if you could point out that there are other ways to dispose of it, that you would have the power to enforce it?

Mr. FULLER. I have been to Sacramento twice, and we have not achieved the success that we had anticipated when we went to Sacramento to get additional legislation. This committee knows as well as I that some of this legislation is extremely controversial and there are areas of sensitivity, and it should have no place in the enforcement of air pollution laws, and in my opinion as an enforcement officer and as a peace officer for 30 years, there should be no discrimination as far as the enforcement of the health and safety code with respect to the welfare of the public in this county. If it is air pollution, it should be stopped regardless of who puts it out, and if the law needs to be strengthened in any of the sections of the health and safety code, then it should be strengthened.

Mr. ROOSEVELT. I only mention this for the record. Obviously when you come to the Federal Government or when any area comes to the Federal Government for assistance, it is more difficult to get Federal funds allocated for the problem unless there is a feeling that the utmost is being done by the local unit and by the State unit to provide its own protection.

Mr. FULLER. I would assure this committee that everything possible is being done as far as the district's policy is concerned and the matter of enforcement. We don't care who it is and we don't care when it happens.

Mr. ROOSEVELT. But you are stating, however, that the State law is not as efficient as it should be, to summarize it.

Mr. FULLER. That is correct.

Mr. SHEEHAN. Would you have any idea what the thinking was behind the State legislature when they exempted the city or local governing bodies from this law?

Mr. FULLER. Yes.

Mr. SHEEHAN. What was that?

Mr. FULLER. Well, as a result of me taking action to cite two of the city officials into the courts of this county, and action against school districts in the county, a bill was drafted and presented at the last regular session and was approved and signed by the Governor and made law, and is now in effect. I shall be very happy to read it to you if you wish. I have it here and will be glad to give a copy of it to the committee.

Mr. SHEEHAN. What is the gist of it?

Mr. FULLER. It says:

> Notwithstanding any other provision of the law to the contrary, no State or local official or employee thereof shall be criminally responsible for violations under this section.

Mr. ROOSEVELT. I think what Mr. Sheehan was trying to get at is this: Is this simply a selfish protection that they gave themselves or was there some valid reason to give them this exemption?

Mr. GRISWOLD. The background of reasoning is, Congressman, that as public servants and officials that they would cooperate with another governmental agency, namely, the air pollution control district to comply with all existing rules and regulations and ordinances and everything else that was passed, and that as public officials that they could be expected to do that, and therefore as representatives of the people they shouldn't be put in jail on the very few, or be brought before the court as a misdemeanant in the event that there was a slip somewhere down the line and somebody did something carelessly, you know.

Mr. SHEEHAN. That philosophy I would agree with, but I might be mistaken, but as I understand the situation today, the local governing bodies like school districts and the city incinerators and things like that, that you people can't do anything with them; they are exempt. Is that right or wrong?

Mr. GRISWOLD. It is right, Congressman, that they are exempt. It is not right if you have the idea that local governmental agencies generate any appreciable amount of air pollution. They don't. For instance, the Los Angeles City—I would say those that do are so rare as to be unusual. They have the loophole in the law. What Captain Fuller means to describe here is the fact that, taking the bureau of water and power, which is a public power agency, they can construct a powerplant on their own design without submitting the plans to us and getting the permits to construct, including all of the air pollution devices which, say, the Southern California Edison Co. could not do. It is the same sort of thing. They can then construct this plant and proceed to operate it regardless of what it puts into the air, whereas the Southern California Edison Co. cannot. Now, over that we can have no control. If their plant violates without black smoke, we write them a letter and say, "There was a slight aberration last week, and we think you should do something about the total air pollution problem instead of sticking a stack up higher in the air to spread it out over a larger area," whereas with Southern California Edison Co., we would cite them into court, and the judge would fine them, and the plant manager would appear.

Mr. SHEEHAN. Do they cooperate? Do they cooperate in abating this nuisance?

Mr. GRISWOLD. That depends upon the particular agency and the particular individual. For the most part, they do.

Mr. SHEEHAN. But isn't this thing serious enough that it can't be a question of "for the most part," but that it must be total compliance? The city of Los Angeles is developing power and the Southern California Edison Co. is developing power, and they are both a nuisance insofar as what they put into the air.

Mr. GRISWOLD. That is true, and that is why, as Captain Fuller mentioned it, at the last session of the legislature, senate bill 59 was introduced to bring them fully within the rules and regulations of the district, but they are not.

Mr. SHEEHAN. Well, the point that I am getting at, Mr. Chairman, is simply this, as we started our meeting yesterday we saw a lot of public-spirited citizens outside with campaign cards and things like that and it looks to me like this is one of the places that they can get at, the city government and their own county government, which is a violator and yet no one can do anything about it. Nothing can be done about it technically speaking.

Mr. GRISWOLD. Not from a criminal standpoint.

Mr. SHEEHAN. Well, what other way can you do anything about it? You can't force them to put on a smoke abatement device, can you?

Mr. FULLER. No.

Mr. GRISWOLD. Congressman, one of the biggest, the one organization in town when we arrived at the Air Pollution Control District, Mr. Fuller and I, that had the greatest number of citations for violation of air pollution rules and regulations was the public schools of the city of Los Angeles, and they certainly know better than anybody in private industry that it is as much a health hazard as for Southern California Edison Co. Rather than jeopardize my public indignation over that fact in the general advertising of it, a little over a year ago they not only made arrangements to haul a lot of that stuff to cut and cover sites, but they have taken other effective methods and measures and are now engaged in a program of teaching air pollution, the techniques of air pollution control in the public schools.

Mr. SHEEHAN. Well, of course, if they take effective measures to eliminate it, we can have no argument about it.

Mr. GRISWOLD. Yes. However, there would be one or two instead of literally hundreds of them as before, as soon as they understood the problem and what they had to do with it. Now, I still say that they should be just as much under the rules and regulations as the district.

Mr. SHEEHAN. Right.

Mr. ROOSEVELT. We are not trying to assess blame here.

Mr. GRISWOLD. But to think that public agencies per se constitute a large portion of our air-pollution problem, they do not.

Mr. SHEEHAN. Do you want to make a guess as to what proportion they constitute?

Mr. GRISWOLD. It would be a horseback estimate, and because of the many activities they are engaged in, I would hesitate to say, but I would say the largest contribution made by a public agency would be the city bureau of water and power, and as of right now there are no controls possible on steam powerplants. The Southern California Edison Co. allocated a million and three-quarter dollars to undertake the research on those controls and do the prototype work on it. Those controls have been tailormade, the first ones, definitely. The bureau of water and power is cooperating with that joint committee along

with the district engineers, as are Pasadena, Glendale, and Burbank municipally owned powerplants, although they are not appropriating funds to it. However, they are assigning technical engineers and consultants to the project.

Mr. SHEEHAN. Even so, after the device is finally developed by Southern California Edison, plus the other men, the city of Pasadena can tell everybody to go jump in the lake.

Mr. GRISWOLD. Legally they can. I doubt whether they would do it or not.

Mr. PRICHARD. May I ask a question, Mr. Chairman?

Mr. ROOSEVELT. Yes.

Mr. PRICHARD. Along that same line. You people have made estimates that approximately so many tons of pollutants are cast into the air per day despite—or that isn't the word—but even under the terms of your regulations. Have you made any calculations as to how efficient your enforcement is? Obviously you can't be 100 percent efficient. There is some lag, so that there is an escape from regulation to a degree. Have you made any calculation as to how much in the way of pollutants are cast into the air per day by violators?

Mr. ROOSEVELT. Mr. Prichard, may I add to that: Have you also statistics, for instance—it must be that of the total industrial emission into the air you could probably pin it down to, let's say, a hundred units that have contributed considerable and made an important contribution. Do you keep any figures on that or do you have any direct control over that so that you can have a greater enforcement in relation to those, let's say, most important 100?

Mr. FULLER. You are talking about selective enforcement, in other words, the greatest enforcements as to the greatest source of air pollution.

Mr. ROOSEVELT. Yes.

Mr. FULLER. We have those installations under 24-hour surveillance. I am talking about refineries. I am talking about the big powerplants, and all of the large major sources of air pollution.

Mr. ROOSEVELT. But you have no technical device which gives you an exact knowledge as to when they are violating the law and when they are not, in other words, this is visual enforcement?

Mr. FULLER. That is right, and it would be extremely difficult, in fact impossible, without an actual source test to determine, to make a quantitative and qualitative analysis of the emissions.

Mr. ROOSEVELT. And there is no piece of machinery available which you could require to be installed which would tell you at what hour of the day they were emitting more than an allowable amount?

Mr. FULLER. In other words, you are talking about a measuring device which would by itself under lock and key reveal to us that they violated at 2 o'clock in the morning.

Mr. ROOSEVELT. That is exactly what I am talking about.

Mr. FULLER. I don't know of any such device. I doubt that there is one in existence. It would require an extreme degree of accuracy and would require a chemical analysis which one single operation could not perform.

Mr. ROOSEVELT. Well, if I may disagree with you on that point, you know exactly the kind of emission that comes out of certain areas. Therefore you would not have to measure it as to its qualita-

tive aspects. It would only be important as to its quantitative aspects. So therefore, why couldn't you set it up to regulate it?

Mr. FULLER. If you were to determine, for example, a violation of a rule which provides that there shall not be in excess of 0.4 grains per cubic foot, calculated at 12 percent——

Mr. ROOSEVELT. That is what you do visually, isn't it?

Mr. FULLER. No.

Mr. ROOSEVELT. Don't you say there is too much smoke coming out of that stack by your visual judgment?

Mr. FULLER. No. Well, we do visually grade the densities and opacities of smoke which our inspectors are trained to do within 5 percent degree of accuracy, but this does not take into effect the quality and the degree, for example, which would be a separate violation. It does not take into effect the concentration of SO_2 in the emission itself. There would be no way of determining by metering whether or not this was in excess, to my knowledge, and for the record again, I am not an engineer. I want to make that perfectly clear.

Mr. ROOSEVELT. Mr. Crabaugh, do you want to answer this? If you would come forward a minute.

Mr. PRICHARD. May I ask a question along that line?

Mr. ROOSEVELT. Yes, sir.

Mr. PRICHARD. Let's come back to it, then. Is there any way of telling what degree of efficiency your enforcement has?

Mr. FULLER. Only with respect to the number of sources abated, but I might say to you this, that there is an area there that you cannot calculate. For example, take a certain classification of industry, the meat-packing industry. There are some 15 right now in this area. We have brought them to account, and they are presently all joined into a single variance issued by the hearing board for the purpose of controlling the emissions on the meat-curing process and smoking process. Many, many thousands of dollars have been spent by one company for the purpose of developing the devices which will be applicable to all when they are concluded, and that should be in the next couple of months.

Mr. PRICHARD. Well, take for example an oil refinery.

Mr. FULLER. Yes.

Mr. PRICHARD. Now, whether it is complying with the law or violating the law is a matter of visual observation; is that correct?

Mr. FULLER. Not entirely.

Mr. GRISWOLD. No; that is only only one small part of it, Mr. Prichard.

Mr. PRICHARD. That is what I am trying to find out.

Mr. GRISWOLD. The fact that this oil refinery is even built here, in the first place, they can't even break the ground without submitting their plans to the air-pollution control district, to Mr. Crabaugh's engineering division, his petroleum engineers, refinery engineers, to review those plans in detail to see that included in the plans for that refinery, if one was being built, and there aren't any being built here now——

Mr. ROOSEVELT. Let's stick to the ones that are built.

Mr. GRISWOLD. Say Richfield Oil. They are the latest refiner that came in here. They submitted their detailed plans to the engineering——

Mr. ROOSEVELT. We are not talking about the ones that you approved that are set up according to the methods you approved. We are talking about the ones already built that were already here and that now you have to supervise to see that they do not violate the regulations.

Mr. GRISWOLD. In other words, you say that the refineries might do something at night that they don't do in the daytime, and that sort of thing.

Mr. ROOSEVELT. Right.

Mr. FULLER. That is my job, and if they do it at night, they are hauled into court, and they have been.

Mr. PRICHARD. How do you know they are doing it at night?

Mr. FULLER. Because of the inspectors there on the job making inspections, chemical engineers.

Mr. PRICHARD. Visual inspection?

Mr. FULLER. Not only visual, but with instruments to determine H_2S, S_2O, and so forth.

Mr. ROOSEVELT. That is what I asked you. If there are instruments which can measure it, which you tell me now that there are instruments which can measure it, why can't you put a metering device on it so that it is not subject to Mr. Jones or somebody else's responsibility that you assign there that might go to sleep on the job; you have a piece of mechanism that will enable you to know at all times exactly what is coming out of that smokestack?

Mr. FULLER. From what I have heard, I don't think it can be done.

Mr. CRABAUGH. It is possible in some cases, not in every case.

Mr. ROOSEVELT. In which cases it is possible?

Mr. CRABAUGH. For instance, in some of the hot asphalt plants we have tested these ourselves where we know the ratio between say the amount of water in the water tower and scrubbing tower versus the amount of dust coming out of the stack and we require these people to put a full meter in on the water supply to supply enough water to the scrubbing tower to keep this discharge down below the allowable which in this case is expressed in pounds per hour.

Mr. ROOSEVELT. So you have done it for that industry.

Mr. CRABAUGH. We have done it for this.

Mr. ROOSEVELT. What industries haven't you done it for?

Mr. CRABAUGH. There are a great many where we know of no method that has been devised that will give us the information.

Mr. ROOSEVELT. Are you conducting any research to find such a method?

Mr. CRABAUGH. Every one that we find where we can do something under our permit system, we require it as a matter of course.

Mr. ROOSEVELT. I didn't ask you that. What I asked you was are you doing any research to find out how you could put such a control device into effect in those industries which today do not have it?

Mr. CRABAUGH. We are doing our darndest to watch every bit of technical data that is coming out that might have something to do with it.

Mr. ROOSEVELT. But the district itself is not doing any research on that subject?

Mr. GRISWOLD. If you mean, Congressman, does the district have engineers specifically assigned to that, the answer is definitely no. The reason for that is, and this is just a point, is that industry is

coming into this area at the rate so that we have to keep them waiting to process their plans anywhere from 60 to 90 days.

Mr. ROOSEVELT. That is because you don't have enough engineers, and yet the board of supervisors testified in Mr. Will's testimony that if you wanted more money, up to $24 million, they would give it to you tomorrow.

Mr. FULLER. That is not the answer. We could have $140 million.

Mr. ROOSEVELT. You mean there aren't enough engineers available?

Mr. FULLER. Those people aren't available.

Mr. ROOSEVELT. I think you better get to work with UCLA to produce more engineers.

Mr. GRISWOLD. They don't qualify. We don't have a single UCLA engineer on our staff.

Mr. PRICHARD. Even though it is just an educated guess, Mr. Griswold, just tell us, if you know, please, what in your opinion is the rate of efficiency of your enforcement.

Mr. FULLER. As far as the enforcement application, the rate of efficiency is 100 percent.

Mr. GRISWOLD. The enforcement is the best enforcement activity in the whole United States on air pollution.

Mr. ROOSEVELT. You are begging the question. If you had available so that you could enforce the law 100 percent, naturally that would be the perfect condition. How near perfect are you? Are you 50 percent. It is not a criticism. You are doing the best you can, and we grant you that and we are saying that you are operating at the maximum that you can operate at, but how close is that to perfection?

Mr. FULLER. I will answer your question, but first let me give you an idea of the area controlled by one inspector: 212 square miles of the San Fernando Valley, plus Palmdale and Lancaster thrown in, one inspector. Now, you tell me what the efficiency is.

Mr. ROOSEVELT. I would say 1 percent.

Mr. FULLER. All right. Now, I don't know. I don't know if I had 10,000 inspectors that the enforcement effort would reduce air pollution all by itself. This is not the total answer.

Mr. ROOSEVELT. I thoroughly agree with you. I think that what must be developed here is a more mechanical way of enforcement.

Mr. FULLER. I agree.

Mr. ROOSEVELT. And rather than individuals, trying to have 20,000 inspectors. You tell me the reason you haven't been able to do that is the lack of competent engineers or scientists to work this out, and there I admit I am up a tree.

Mr. FULLER. I don't even have a full staff of inspectors, and I have been trying valiantly for 18 months to get a full staff. I have 62, and I have a full authorization strength of 70.

Mr. PRICHARD. Mr. Fuller, we know that it isn't 100 percent. There sits the sheriff back there. He will tell you that he doesn't catch 100 percent of the burglars.

Mr. FULLER. That is true. I said that the application of enforcement was 100 percent effective.

Mr. ROOSEVELT. Within the tools which you have available.

Mr. FULLER. Right.

Mr. ROOSEVELT. I wouldn't quarrel with that.

Mr. SHEEHAN. In other words, with 100 percent enforcement, there would be no pollution.

Mr. FULLER. We are devoting 100 percent of effort on the part of the personnel of this department, of this district, 24 hours a day, and I will tell this committee right here now, I don't know of a single source in Los Angeles County that is violating the law, and if this committee knows of any such source, I would be very happy to be out there as soon as I leave this chair.

Mr. PRICHARD. There has been some testimony about scavenger plants breaking down with such terrific regularity. Where do we stand on scavenger plants?

Mr. FULLER. How do you mean? Do I prosecute them? The answer is "Yes."

Mr. PRICHARD. Do they break down?

Mr. ROOSEVELT. What happens when they break down? I believe the testimony was that they were down 50 days—am I correct, 50 days; is that correct?

Mr. PRICHARD. I understood there were 50 days last year that the scavenger plants were out of operation.

Mr. ROOSEVELT. What happens then? They must be violating the law for 50 days, or somebody must be.

Mr. CRABAUGH. I can explain that. The scavenger plants are normally receiving hydrogen sulfide from one of the oil refineries. Now, when a scavenger plant goes off the line, the hydrogen sulfide is then diverted back into a boiler firebox. In being burned in this case, partially using the fuel, we object to this discharge; in fact, we have tons coming out of the refinery stacks, but there is no technical violation of our law because in running it back through the heater and boiler stacks they have diluted it with enough natural gas or oil or flue gases so that the sulfur dioxide content is low, but we have a large amount tonagewise being discharged.

Mr. ROOSEVELT. However, does not that, added to the other, make it a hazard or add to the hazard?

Mr. CRABAUGH. It adds to the sulfur dioxide problem in the county, and we are trying to keep it as low as we can.

Mr. FULLER. It is much less hazardous than if the H_2S were released by itself unburned.

Mr. CRABAUGH. If the H_2S was released by itself, you would have people dying right at the plant.

Mr. GRISWOLD. But even there, we just granted a permit to Hancock Chemical which, for instance, takes the H_2S from three refineries—Richfield, Texas, and General Petroleum, don't they—and because of the work that we have done with this concern, they have so designed this new plant so that when one of them breaks that they can take it apart and work on it one-half at a time and with very slight overload the remaining half can carry the full load so it won't have to be flared or burned as fuel. Now, that is one of the first times that has been done too. Heretofore, because you absorb the H_2S, the hydrogen sulfide or the rotten egg gas in a very expensive diaptholmy—it is called—train, and take it from the refinery to the scavenger plant, when something breaks down the train doesn't move; they can't strip the hydrogen sulfide from the liquid and they have to flare it, unless you shut down the refinery, and shutting down a refinery without due cause is something of a problem legally.

Mr. PRICHARD. Isn't that due cause, Mr. Griswold?

Mr. GRISWOLD. Not unless you can show that it damages the health and welfare of the individual.

Mr. PRICHARD. Isn't that the whole supposition of your air-pollution program?

Mr. GRISWOLD. That is right. However, when you did that you would be faced immediately with one little thing that we have actually less sulfur dioxide in the air over Los Angeles generally than there is in Chicago or any other big city in the United States that burns soft coal and the people are still alive there.

Mr. SHEEHAN. I agree.

Mr. ROOSEVELT. All right, may I ask you one other question? Do you grant variances to industries?

Mr. FULLER. No.

Mr. CRABAUGH. No.

Mr. GRISWOLD. No. The hearing board does that. For instance, many industries feel that the ruling of the district is very arbitrary or that they can't live with them or that they require time to do these things, and their court of appeals is the hearing board, like we denied the permit of the Southern California Edison Co.——

Mr. ROOSEVELT. But don't you have the initial right, however, to make your own ruling which would in essence be a ruling that would be a variance?

Mr. GRISWOLD. Oh, yes.

Mr. FULLER. The air pollution control officer denies it; if he does, they can take the suit to the hearing board.

Mr. ROOSEVELT. Supposing you grant it?

Mr. CRABAUGH. Then there is no contest.

Mr. ROOSEVELT. Wait a minute. The suspicion has been voiced that perhaps it is granted to some people and denied to other people. Are these matters of public record?

Mr. CRABAUGH. Certainly.

Mr. FULLER. Oh, yes.

Mr. ROOSEVELT. All variances or whatever you call them that are granted are matters of public record for anybody to see?

Mr. FULLER. Yes, sir.

Mr. ROOSEVELT. I believe there was testimony before the committee this morning that certain other records were not made available upon request or only partially upon request. I think you were here, Mr. Griswold. Would you care to comment on that for the record?

Mr. FULLER. Yes; I would be very happy to comment on it. I heard the testimony this morning. I am sorry I am not under oath.

Mr. ROOSEVELT. We consider you under oath. You are a public official, and we consider you under oath.

Mr. FULLER. Thank you. When Mr. Packard came to the district and asked for the records of this particular scavenger plant, I was not present. I was away from my desk. When I returned I found that records had been delivered to Mr. Packard which contained records other than what had been determined by the county counsel to be public records. I had the records removed from the presence of Mr. Packard and I explained to him at that time, and I can almost quote, I said, "Not only will I give you a copy of these records, but I will run off additional copies so that you may have enough for your entire committee if the county counsel rules that these particular records are public records."

Now, I am subject to suit, as you know. So I explained to him the situation, and this was my legal adviser, and I dispatched an immediate letter to the county counsel and showed the record to him and asked for his legal opinion, and his opinion was that these were not public records, and the reason they were not—and I will be very happy to explain. If you, sir, were in business in Los Angeles County and had spent many millions of dollars to perfect a certain process for making a certain product as to which there was extreme competition in the field, you would want this controlled and kept tight top secret; this is your livelihood. Consequently, when we require by law from industry or any manufacturing process that they submit to us these confidential plans as to processing and manufacture and so forth, they just don't want to submit these plans, but we have forced them to. I doubt that anybody here knows the composition of Coca-Cola. This has been a very closely guarded secret in the industry. So with the exception of those particular types of records which belong to the private files of the particular company, any other record in this district including those of scavenger plants are public records, and I will be very happy to provide to any person any schedule of breakdowns of scavenger plants. This is public record. But as to the processes and so forth of this multimillion dollar industry, this the county counsel said is not public record, and therefore I refused to give the records to Mr. Packard.

Mr. PRICHARD. Mr. Fuller, in that regard isn't it a fact that the only thing that he asked you for was the number of days and the designation of the days when the scavenger plants were shut down?

Mr. FULLER. No. Mr. Packard had the entire files of the company there spread out on the table when I arrived.

Mr. PRICHARD. Whether the district had given him all of the files or not, all that he asked for, is it not a fact, was the designation of the days so that they could be identified as to when the scavenger plants were shut down?

Mr. FULLER. That is not my recollection. If that was all that he had asked for, he could have gotten a printed list of the days and hours when those plants were down.

Mr. ROOSEVELT. Could we have it tomorrow?

Mr. FULLER. Certainly.

Mr. ROOSEVELT. Not tomorrow, but Monday.

Mr. PRICHARD. Let's make it about Wednesday of next week. It is very important for this committee.

Mr. FULLER. If you will specifically tell me what you want and make it a matter of record, I will see that it is delivered to you.

Mr. PRICHARD. I want the days designated as to when the scavenger plants in this county were shut down during the last fiscal year, beginning with July 1 of last year.

Mr. ROOSEVELT. I think we should properly, however, make that a matter of record and deliver it in written form in order that there can be no question or misunderstanding from a verbal request.

Mr. FULLER. Thank you.

(The information requested is as follows:)

AIR POLLUTION CONTROL DISTRICT

SCAVENGER PLANT SHUTDOWN PERIODS

The following report contains the dates and the total hours of shutdown of the sulphur recovery or scavenger plants in Los Angeles County during the fiscal year beginning July 1, 1955. Please note that the asterisk indicates the period of time when the concerned scavenger plant was shutdown by reason of a planned turn-around operation. This period of shutdown was not due to a breakdown of equipment.

	Hours
Hancock Chemical Co.:	
From Aug. 9 to Aug. 10, 1955	37¾
From Sept. 13 to Sept. 19, 1955	155½
Dec. 12, 1955	3
May 20, 1956	7
From June 17 to June 21, 1956	*116
Stauffer Chemical Co.:	
From Aug. 7 to Aug. 10, 1955	*79
From June 13 to June 17, 1955	*97
General Chemical Co.:	
Dec. 8, 1955	10
Dec. 30, 1955	9
Jan. 10, 1956	12
Feb. 22, 1956	10
Wilshire Oil Co.:	
From July 25 to July 30, 1955	120
From Jan. 7 to Jan. 16, 1956	*218
From Jan. 21 to Jan. 23, 1956	45
June 18, 1956	5½
Union Oil Co.:	
From July 23 to Aug. 7, 1955	*350
Feb. 15, 1956	5¾
From Mar. 31 to Apr. 27, 1956	*648

Mr. ROOSEVELT. It was also testified, I believe, by Mr. Will, that there were a number of cases of small businesses having to go out of business because they could not comply with the statutes that had been set up. Is there any field, do you feel, for the Federal Government to possibly, from your experience, grant financial assistance to such concerns in order that they may have the financial ability to comply? I am particularly talking about a small business loan, for instance, in order that it might not be put out of business and might be able to comply.

Mr. GRISWOLD. Matters of equity are heard by the hearing board, Professor Daugherty, the former Mayor Bowron——

Mr. ROOSEVELT. It was Professor Daugherty who testified to that.

Mr. GRISWOLD. He undoubtedly testified to that. Now, the decisions of the district pertain to whether that process which has been engaged in—and this will come to a head, gentlemen, again on October 1 of 1957 when this ban on single chamber incinerators goes into effect, because many, many small industries are using single chamber incinerators, silo type for lumber yards, various types, chute-fed incinerators for apartment houses, for example, and now a multiple chamber incinerator or hauling, depending upon the amount of stuff they have to haul, will be more expensive. There is no question about it. How much more will depend on the volume and the problem. However it will not be within my purview to give them X days or any additional time by reason of their financial or economic condition. So the hearing board would hear their plea in connection with that, and if there was some good and justifiable reason why it should be continued beyond this October 1 deadline, which has been advertised for

22 months in advance, then they would hear the equities involved, and I believe the hearing board could advise you best on that.

Mr. ROOSEVELT. Well now, specifically, though, that would mean if they found that such a situation existed that they would have to grant an extended time, whereas if financial assistance were available, they could insist that it be done now.

Mr. GRISWOLD. Yes.

Mr. ROOSEVELT. Because of the existence of that financial assistance; therefore, is it not proper for us to consider whether or not we should try to find ways and means of making that financial assistance available so that the hearing board could insist upon compliance immediately?

Mr. GRISWOLD. I believe so.

Mr. ROOSEVELT. Now, to get back to one other thing, as you issue your citations and bring them to court, I believe you testified that that is all a matter of public record.

Mr. FULLER. Yes.

Mr. ROOSEVELT. Can the committee have a description of, let's say, for the year 1955 or such period as will bring us nearest to a current date of the citations, in order that they may be made a part of the record, and I assume that with that you have the specific result of the prosecution——

Mr. FULLER. Fines and so forth?

Mr. ROOSEVELT. Yes.

Mr. FULLER. Yes; here is a report which I shall be happy to submit to the committee. This third sheet is the court cases filed in 1955 by source, and the number of cases by month, and on the second page is the court cases filed, completed, and convictions, and total fines assessed and collected, and so forth, for the year 1954 by month, and 1955 by month, together with——

Mr. ROOSEVELT. Have you the record of the specific companies in order that—in other words, you give me something by source. I will have no way of knowing whether that comprises a big or a little concern.

Mr. FULLER. I don't have them—this is a tremendous thing—by name. I mean there are many thousands——

Mr. PRICHARD. Let's take whatever we have here and then if we need more, we will ask for more.

Mr. ROOSEVELT. The committee will receive this as an exhibit and it will be entered, without objection, at this point.

(The information referred to is as follows:)

EXHIBIT

COURT CASE STATISTICAL REPORT FOR 1955

Air pollution control district, county of Los Angeles, Calif., enforcement division, investigation and record section

The summary which follows shows a month-by-month record for the last 2 years of court cases filed, completed and convicted, and a month-by-month summary of the fines assessed and collected. The column headed "Convicted" includes only those cases where the defendant entered a plea of guilty or was convicted after trial. Where 2 or more cases are combined for plea and the judge dismisses 1 or more cases after a guilty plea on 1 case, only 1 case is shown as a conviction.

The attached summary sheet, page 3, gives a breakdown by type of equipment of all court cases filed by this section during the calendar year 1955. It should be pointed out that the total of sources will not check with the figure given

for the total number of cases filed during 1955. This total number of cases is 2,974. This sheet shows the actual equipment totals, for example, if 1 case was filed against a particular company for a violation of both an incinerator and a boiler, it would be shown as 2 entries in the source column, 1 for incinerator and 1 for boiler. Similarly, if a case was filed for operating an incinerator without a permit, it would be shown as an incinerator and also in the column headed "Constructed, operating without permit."

The large steam plants have been categorized along with the similar small equipment under the heading of "Boilers and steam plants." The same holds true for refineries, which are in a category headed "Chemical and refinery plants." This category covers only the major chemical plants and refineries. A violation from a boiler in a refinery would, of course, be headed with the category summarized in the boiler column. The miscellaneous category includes such sources as dust nuisances from construction projects, asphalt roofing kettles, asphalt saturators, paint bake ovens, lithograph ovens, grinding, crushing equipment, and other industrial sources where only a very few cases were processed during this year. Included is a column headed "Rendering plants" even though there were only 3 companies taken to court during the year, because 2 of these cases were appealed to the appellate division of the California Superior Court.

This report was prepared to be of assistance in planning enforcement activities throughout the calendar year 1956 and the fiscal year 1956–57. It should be studied primarily to look into the future with the secondary purpose of reporting what has occurred throughout the past year.

Court cases filed, completed, convictions, total fines assessed and collected from Jan. 1, 1954, to and including Dec. 31, 1955

	Filed	Completed	Convicted	Fines assessed	Fines collected
1954—January	31	36	33	$3,735	$1,300.00
February	23	29	22	1,575	625.00
March	38	33	31	3,105	1,105.00
April	19	38	28	2,320	1,060.00
May	26	15	12	625	315.00
June	25	25	22	1,930	450.00
July	28	28	28	1,200	975.00
August	20	18	15	1,155	945.00
September	30	25	22	1,650	425.00
October	16	18	14	1,800	425.00
November	22	15	15	620	590.00
December	117	37	34	2,860	1,510.00
Total	395	316	[1] 276	22,575	9,725.00
1955—January	158	130	122	7,875	4,865.00
February	140	168	154	13,550	6,060.00
March	212	168	155	9,245	4,440.00
April	235	230	215	12,977	5,952.00
May	233	213	196	10,582	5,907.00
June	206	208	192	13,226	7,209.00
July	287	222	203	12,349	5,028.00
August	280	244	233	17,615	7,604.50
September	404	239	215	13,146	6,142.00
October	340	316	280	11,378	6,952.00
November	295	310	290	8,725	6,476.00
December	184	270	253	8,567	5,642.00
Total	2,974	2,718	[2] 2,508	139,235	72,277.50

[1] 87.5 percent convicted.
[2] 92.3 percent convicted.

Court cases filed, 1965, by source

Month	Incinerators	Boilers and steam plants	Open fires	Cupolas	Bagh ouses	Nonferrous furnaces	Vehicles	Hot asphalt plants	Concrete batch plants	Heat treat furnaces	Local exhaust systems	Dust collectors	Electrical precipitators	Electric fees	Rendering plants	Water scrubbers	Paint spray booths	Orchard heaters	Smokehouses	Chemical and refinery plants	Glass furnaces	Miscellaneous	Constructed, operating w/o permit	Contrary permits 24280	Obstructing APCO 24246	Rule 67
January	45	13	33	3	1	4	28	2	2	1				1	2			8			1	9	3			
February	39	27	38	1	1	3	19				1	2				3			1		1	4				
March	48	9	65	1	1	3	56	1	1	1	4	1	1	1		1	1	6	2	5	2	7	6			
April	44	11	66	2		4	89				2	1	1	1		2	3	1	2	1	1	7	11			
May	53	11	44	2		3	105				1						3			1		7	22			
June	51	6	58	1		4	67					2		1	1		1					6	20	1		
July	101	13	70	1		2	67			1	3	1	1	1		2	5			1		15	20			
August	80	10	67	2	4	2	75	1		4		1	2	1								18	10			
September	57	9	49	2		8	265				3			1		2						9	4			
October	33	5	44	1	1	4	253		1				1	1					1			1	7			12
November	27	6	72			1	181				3			1			1					2	6			53
December	38	14	48	1		2	66				2			2								7				26
Total	614	134	614	17	8	36	1,272	4	4	8	19	8	6	10	3	8	16	15	8	9	5	96	128	3	1	91

Mr. ROOSEVELT. However, you only had a certain number. What was the total number of citations processed in 1955?

Mr. FULLER. Just under 3,000.

Mr. ROOSEVELT. So that all you would have to do would be to give us a list of 3,000 names.

Mr. FULLER. Oh, yes. You mean you want the names?

Mr. ROOSEVELT. Yes.

Mr. FULLER. Yes; that can be determined.

Mr. ROOSEVELT. May I suggest that you supply the committee with those 3,000 names?

Mr. FULLER. Now, this becomes——

Mr. ROOSEVELT. I don't want it tomorrow or the next day.

Mr. FULLER. But I want to be sure, because under the health and safety code we cite both the employer and the employee—A B C Co. and John Smith. This becomes quite involved when you get corporations which have a dozen names for partners.

Mr. ROOSEVELT. I will be satisfied with the corporate name.

Mr. FULLER. The corporate name and the individual?

Mr. ROOSEVELT. No; just the corporate name.

Mr. SHEEHAN. Unless it is an individual or proprietorship.

Mr. ROOSEVELT. Unless an individual or a partnership which you have cited.

Mr. FULLER. I understand what you want, but there are many ramifications to the citing of these various people into court where you get ramifications of companies that have gone out of business and corporations picked up later, and there have to be filed and refiled these things until you get the proper person, but I will submit to this committee as rapidly as it can be developed the figures on 1955 on those 3,000 violations.

Mr. ROOSEVELT. Do the best you can. If you will send it to the House Small Business Committee, Washington, D. C.

Mr. FULLER. All right.

(The information was subsequently supplied and is in the subcommittee files.)

Mr. ROOSEVELT. Mr. Steed, any further questions?

Mr. STEED. No.

Mr. ROOSEVELT. Do you have anything further?

Mr. SHEEHAN. Let's go home.

Mr. ROOSEVELT. Mr. Prichard?

Mr. PRICHARD. No.

Mr. ROOSEVELT. Mr. Biscailuz?

Mr. BISCAILUZ. No. The subject seems to be pretty well exhausted.

Mr. ROOSEVELT. We want to, and I want to, on behalf of the committee, thank you, Mr. Griswold, for the cooperation which you and the members of your staff have given us. We are very grateful to you, and I presume if we have further questions we may have the privilege of putting them to you in writing so that you may reply to them, because we probably won't be able to come back.

Mr. GRISWOLD. Thank you. Might I make a final statement in connection with this hearing just for your record—I won't read it—that sets forth the specific recommendations which we would like to have the Federal Government consider in connection with air pollution in this area?

Mr. ROOSEVELT. We will be very happy to have it, and we appreciate the constructive suggestions which you have submitted for consideration.

(The statement referred to follows:)

STATEMENT OF S. SMITH GRISWOLD

Testimony already presented has established the peculiar character of the Los Angeles smog problem, and its scope and magnitude has further demonstrated that an active program of smog control is being pursued by local and State authorities.

The big question now, of course, is Where do we go from here? Our 8-year experience has taught us one fundamental lesson, namely, that the smog problem in Los Angeles and in other large urban areas is sufficiently complex and important that it cannot be solved by the unilateral action of single local authorities whose budgetary, manpower, and brainpower supplies are strictly limited.

The smog abatement programs now underway throughout the Nation involve, among other elements, a race against time. Our urban atmospheres are now polluted to a substantial degree. That the pollution concentrations have produced considerable public discomfort is obvious. That existing and future concentrations may be hazardous to the public health and safety is suggested by medical research now underway, but by no means yet completed.

And so what is required is an all-out effort that must involve every level of government—Federal, State, and local—and every major industry, with each performing that activity for which it is best equipped.

Granted that local government is all important in the enforcement of antismog laws, and the application of smog-control measures, but there are no magical remedies, model ordinances, or mysterious laws which can be applied to the solution of this problem at this time. They can only result from careful research in many areas, and the development of tailormade, engineered controls to each of the numerous contaminants identified as important.

To emphasize this I might underscore the point that there are no basic smog-control regulations which could be adopted by this district at this time other than those already on the books. More will be adopted in the future and more will be adopted yet this year. But they cannot be adopted until the answers are known, the technical questions resolved, and the basic developmental work completed. At this local level we cannot move any faster than we are at this time unless we receive the full and unqualified support of industry and of each level of government, particularly the Federal Government.

And in regard to the Federal Government, I might add that their full and unqualified support has not yet been forthcoming.

Our experience in controlling air pollution here in Los Angeles County indicates strongly to us the need for a comprehensive, dynamic, and forceful research, developmental, and educational program at the Federal level.

Three separate factors suggest the need for such a program at the Federal level:

1. Los Angeles County, and other urban areas, simply cannot independently cope with all the many technical and scientific factors associated with effective control efforts. This entire field of air-pollution control is so new that it is fraught with countless unknowns. To secure answers to the many questions confronting us there must be an effective division of effort between the several levels of government. Without that kind of cooperative approach the solution to the smog problem here and in other metropolitan areas will be dangerously slow.

2. Much positive and constructive data and information regarding air pollution and its control has already been developed by local agencies, particularly here in Los Angeles where the most comprehensive local program in the Nation is being administered. This existing information should be correlated and made available to all control agencies through central coordination at the Federal level. There is no need to duplicate research or engineering development projects already completed or well on the way to completion here in Los Angeles and in other metropolitan areas.

3. Federal financial assistance through grants-in-aid or contract research projects should be made available to local agencies conducting work of national interest. Local governmental budgets are already strained to the breaking point and they should not now be required to spend local tax funds on projects that are of benefit to the entire Nation.

There are several general areas in which we feel that strong Federal action should be taken:

1. The coordination at the national level of all research and developmental projects now being performed at widely separated points throughout the Nation.

This activity should include the accumulation and interchange of a national reservoir of authentic and accurate information in the field of air pollution and air-pollution control.

2. The development, refinement, and standardization of analytical and instrumentation methods to be employed in air monitoring activities.

3. The development of automatic instruments for use in air sampling.

4. Development, refinement, and standardization of methods and equipment for source testing activities.

5. Research in the broad field of atmospheric chemistry to identify the contaminants present in urban atmospheres and their relative importance to the total problem of air pollution, including their effects on the public health, welfare, and comfort, as well as their effects on property and vegetation.

6. Participation, technically and financially, in the development of controls for key sources, including automotive exhausts and various industrial sources.

In each of these areas, considerable work has already been completed or is underway in the Los Angeles County Air Pollution Control District and in other local agencies.

These possible areas of activity have been thoroughly discussed with representatives of the Federal Government. At a conference held in Berkeley, Calif., earlier this year, representatives of the United States Department of Health, Education, and Welfare, together with representatives of the State of California, Los Angeles County, other local jurisdictions, and private research and educational institutions, collectively agreed to the need for a series of research projects in both the health and environmental areas.

As agreed at that meeting, the Los Angeles County Air Pollution Control District submitted to the United States Surgeon General, through the State department of public health, a formal application for Federal funds to be used in completing nine separate research projects of regional and national interest, the need for each of which had been established at the Berkeley conference.

With your permission, I should like to introduce into the record of this hearing a complete and true copy of that application.

We feel that at this time the following specific actions should be taken by the United States Congress and the United States Department of Health, Education, and Welfare:

1. An increase in the Federal appropriation for air-pollution research to a level approximating $4 million.

2. The allocation of approximately $705,000 to the Los Angeles County Air Pollution Control District to finance a portion of the costs necessary to the completion of the specific projects listed in the district's application of March 1, 1956.

3. The relocation of the Federal air-pollution research center to areas more directly affected by the problems of air pollution, such as Los Angeles County.

Mr. ROOSEVELT. I would like to say at this time that the committee would particularly like to express its appreciation to Mr. Prichard for his wonderful voluntary service to the committee. We would also like to thank Mr. and Mrs. Chivers for the record for the time that they gave to the committee in helping us to prepare the agenda and to prepare the witnesses before the committee.

I would at this time like to make a very brief statement summarizing on behalf of the committee members and the staff of the committee a few of the points which will be the basis of our report which will be put together as rapidly as we can assimilate the mass of material which I am sure you all realize is rather voluminous that we have acquired over the last 2 days.

Mr. PRICHARD. Before you make that statement, Mr. Chairman, may I amplify the total record here?

Mr. ROOSEVELT. Yes, I wish you would.

Mr. PRICHARD. First of all, I want to have marked by the committee as exhibits the two books which Mr. John Maga referred to in his testimony, and which I do not think were specifically marked as constituting exhibits. They contain certain conclusions by the State authorities with reference to the health problem that is involved here, which I think is significant, and which should constitute a part of the record.

Mr. ROOSEVELT. Without objection, we will receive them and mark them for the record as being on file in the committee for reference.

Mr. PRICHARD. Now, I also have a statement from Mr. Frank L. Alexander. You indicated that additional witnesses could not testify, and he has given me a written statement as to what he wanted to put in the record.

Mr. ROOSEVELT. Without objection, it will be received and placed in the record.

(The statement referred to follows:)

WILMINGTON, CALIF., *May 19, 1956.*

Hon. JAMES ROOSEVELT,
Chairman, Subcommittee No. 5,
Los Angeles Air Pollution Hearings,
Los Angeles, Calif.

GENTLEMEN: I will appreciate the opportunity of appearing before your committee to explain briefly the history of Los Angeles smog. I have made a careful study for the past 10 years of the situation that exists, and of the true causes of smog.

I have appeared before most of the State and city hearings that have been held on this subject and I believe that I can give information valuable to your committee. I have visited all the large industrial areas of the United States with particular attention being paid to any similarity that might exist between the air-pollution problems of other cities and that existing in Los Angeles. I spent 3 months in Europe in 1953, visiting all the heavy industrial areas as well as the large cities, trying to see if there was any situation even faintly resembling the condition existing in Los Angeles today. I found there was none.

The cause of smog in Los Angeles is easily explained. I would like the opportunity of doing so. I can substantiate my claims by reference to conversations with men such as Dr. Louis C. McCabe, of Washington, D. C., and Dr. A. C. Metcalf, director of the Kew Gardens of London, England.

I also represent an industry which has already been seriously damaged by the enforcement of unnecessary air-pollution regulations. I am referring to the small lumber and furniture manufacturer, and other small wood users who will be seriously handicapped by the elimination of their refuse burners on October 1, 1957.

Thanking you for the opportunity of appearing before your committee, I remain,

WESTERN DRY KILN & EQUIPMENT CO.,
FRANK L. ALEXANDER, *Owner.*

HISTORY OF LOS ANGELES SMOG—WAR CHEMICAL USED ON BATTLEFIELDS RESPONSIBLE

The first smog attack hit Los Angeles on July 26, 1943, headlined in newspapers of the day as "Strange Gas Attack Strikes Los Angeles, Entire Downtown Area Engulfed by Low-Hanging Acid Clouds." Out of a blue sky smog had struck, suddenly, strangely, violently, and completely mystifying the entire population. This fact alone should convince any rational person that backyard incinerators and automobile exhausts are not to blame for if it were so the effect would have been gradual over the previous 20 years or longer as population and vehicle traffic increased. Also, at that time we were at the peak of the war effort and all industry was on a 24-hour-a-day basis, 7 days a week, yet there had never been any sign of smog and no gradual buildup as industrial activity increased to meet the war demands.

Commencing the early part of September 1943 smog came with us to stay. The oil industry has admitted that the first catalytic cracker in this State started in full-scale operation at the same time. It is only reasonable to assume that trial runs were responsible for the first attacks in July of that year.

In the catalytic-cracking process of manufacturing gasoline the entire body of the crude oil is subjected to temperature in excess of 1,000 degrees, which temperature is sufficient to convert the elemental sulfur, which is a part of all crude oils, to a gaseous state and this gas (symbol S) escapes to the atmosphere where in the still air of a foggy night it unites with ozone (symbol O_3) to form sulfur trioxide (symbol SO_3). Only in the still air of a foggy night can there

be sufficient formation and concentration of sulfur trioxide to cause a smog attack in Los Angeles and Pasadena the following day. In this fog blanket, roughly 20 square miles in area and a few hundred feet thick, there is accumulated all the sulfur that on a clear night would have been dissipated over several thousand cubic miles of ocean air. This becomes in effect a concentrated "chemical cannonball" which will be exploded the following day in Los Angeles or Pasadena if the temperature conditions are right for the sulfur trioxide to vaporize. It is an established fact that a smoggy day in Los Angeles is invariably a hot day following a foggy night on the coast where the refineries are located. Sulfur trioxide is the only chemical which will react exactly under the conditions prevalent in Los Angeles on a smoggy day.

Sulfur trioxide is a chemical little known except to scientists, and to members of Chemical Warfare Service of this and other countries. It is used on the battlefields to create irritating and obscuring clouds to hide troop movements or to hinder the advance of the enemy. It is a colorless, light, mobile liquid floating easily in moist atmosphere and will vaporize only at fairly high temperature in the presence of sunlight. Complete vaporization will take place at 113° F. in the laboratory. In the presence of sunlight the reaction takes place at much lower street-level temperature due to the magnifying effect of sunlight through liquid particles and due to heat generated by chemical reaction. However, the hotter the day the worse the smog due to more complete and rapid vaporization. Sulfur trioxide (symbol SO_3) unites with moisture in the air (H_2O) to form sulfuric acid droplets (H_2SO_4). Thus Los Angeles is subjected to the same kind of an attack that is used on the battlefields in actual warfare. These facts are well known and can be proved.

Dr. Louis C. McCabe, first director of the Air Pollution Control District, revealed the facts of sulfur trioxide in the Los Angeles smog and placed the blame squarely on the oil refineries. Shortly thereafter his services with the Air Pollution Control District were terminated and Mr. Gordon P. Larson was appointed director. Air Pollution Control District publications for the years 1949–51 strongly point out the part sulfur trioxide in the smog picture. However, for the past 3 years the subject of sulfur trioxide has been taboo with the Air Pollution Control District, and they just don't want to talk about it. They are trying to live down the revelations of the past. They are trying to cover up the real cause of smog with a smokescreen of imaginary chemical reaction which is the brainchild of Dr. A. J. Hagen-Smit. Dr. Hagen-Smit comes up with a theory that eye irritation, decrease of visibility, and crop damage are caused by oxidation of hydrocarbons in the atmosphere by photochemical reaction of sunlight in the presence of oxides of nitrogen. That's just a lot of high-sounding nonsense. He mixed a few of these items together in the laboratory and came up with something that irritated the eyes and caused damage when sprayed on vegetation. He could have probably got the same results with Chanel No. 5, Seagrams Seven, Seven-Up, or any of the 57 varieties of Heinz pickles. He has no proof whatsoever that this reaction takes place in the streets and byways of Los Angeles, or in the skies above.

The attempt to lay the blame on backyard incinerators and automobile exhausts is a part of the greatest hoax ever perpetrated in the history of the civilized world. This is an attempt to shift the blame from 6 major oil refineries to the automobiles and the private homes of 4 million people. Backyard incinerators and automobile exhaust have nothing whatsoever to do with smog—never have had and never will have.

We firmly believe that there has existed for over 11 years a criminal conspiracy against the health and welfare of the citizens of Los Angeles in the matter of smog. We believe that there is a sizable group of men in the oil industry, newspaper, financial, and political fields who have known the answers all along and are fully aware of the guilt of the oil industry. We believe that if a sufficient reward is offered that some member of this group will come forward with the truth about this whole sordid affair and provide the information necessary to convict his fellow conspirators. We suggest a million-dollar reward, and herewith offer and subscribe the first thousand dollars toward this reward.

We hope that the Citizens Committee of Pasadena will start the necessary procedure to authorize the offering of such a reward, and we are certain that the million dollars could be easily raised and that such a sum would accomplish the desired results. If backyard incinerators are barred and chemical mufflers become compulsory the expense would exceed $250 million per year to be paid

by the citizens of Los Angeles. One million dollars spent for a reward to prevent such an unnecessary burden would be cheap insurance, and could very well put an end to the world's greatest hoax.

Mr. PRICHARD. I also have a statement in writing on the same basis from Clara McDonald and she has given me a written statement of what her testimony would be.

Mr. ROOSEVELT. Without objection, it will be received and placed in the record.

(The statement referred to follows:)

STATEMENT OF CLARA MCDONALD, PRESIDENT, UNITED PATRIOTIC PEOPLE OF U. S. A.

Gentlemen, my name is Clara McDonald, representing the United Patriotic People of U. S. A. and Griffith-Elysian Chamber of Commerce, active in research and study of transportation and sewage projects for many years. I am also a member of the Citizens Antismog Committee.

The State, by commission action, replaced clean, electrically driven interurban and local cars for buses driven by diesel and gasoline fuel, oxygen consuming, emitting gas of various forms, air pollutants, destructive to human and plant life.

Clean, electrically driven cars should extend to rapid transit of the suspended type, for interurban purpose, the necessary automobile and truck travel on the surface, is thus unimpeded. Of course for long travel flights use the air or sky ride which uses high-grade, clean gasoline. We may need financial help, in order to get something started, local or otherwise, but I believe in free enterprise.

Prior to the war, we experienced very little trouble with the hydrocarbon and nitrogen oxide, at that time gasoline was so clean that we used it effectively for cleaning purposes. For helping remove smog, the use of clean gasoline in our automobiles and buses is a must. This and other causes are known.

The home has not caused our trouble, Government has not functioned for the home, if something is not done now, it will eventually be wholesale murder.

Chemists and engineers who have worked for our organization, claim that sulfur and other air pollutants which cause eye smart, are caused also, by the activated type of sewage in use in the Los Angeles metropolitan area which requires a public stream for an outlet. This type of sewage causes bulking, and bulking is against the law. Statute of limitations on bulking, March 1949, page 17, cause and cure of bulking, quoted in Public Health Engineering Abstracts Sewage Works—Engineering for November 1948: "Answer indicate that all activated sludge plants experience bulking at times, there seems to be no single cause common to all plants."

The California law calls for "pure air." Where do you find it? Santa Monica, El Segunda, and beaches are polluted both as to air and water. Clean air is God given, only governments have permitted its pollution, the Federal Government through the Navy, know full well that it is not essential to pollute any public body of water or, the air of beaches.

They have satisfactory sewers in Paris, France; Berlin, Germany, Clarkdale, Ariz.; St. George, Utah; a plant near San Francisco, Pasadena, with substantial revenue prior to water and power taking over.

From Mr. Arthur Wills, chief administrator of the Los Angeles County Board of Supervisors testimony, the inference seemed to be that the Board had only police power of control. If that be the case some one must step in with a law of mechanical procedure, or, get a new Board.

I have been informed that the mobile units on tuberculosis, operate largely to discover what effect the smog has on the lungs. Some have been waiting for a greater uprising of public opinion, most people must work for a living, there has been a great loss of man-hours and expense, among my acquaintances, due to virus infection doctors admit are caused by smog.

We have been experted taxation wise, by experts, but unnecessary sickness and death is occurring among my friends. I am just getting over a case of virus double pneumonia.

Elected officials in some instances have not been true to their trust. We have given them vital material, only to be ignored. Public officials not true to their trust must be removed, lack of morale, rather than a lack of information, is sometimes visible.

We shall be glad to be of assistance, for we the public, pay all of the bills.

Atomic energy is another manmade form of destruction which can blow up the world.

Eliminate known causes and our smog problem is licked.

Mr. PRICHARD. I believe that it is significant and we should receive a copy of the proceedings of the Southern California Conference on the Elimination of Air Pollution which was held at the Ambassador Hotel on November 10, 1955. Dr. Daugherty supplied me with this. It contains statements from Mr. Griswold, from Dr. Bledsoe, from John Maga, from Dr. Chambers and others who testified in substance and effect on a hearing conducted very much along the lines of this hearing, and as a consequence it contains considerable in the way of supplementary material.

Mr. ROOSEVELT. Without objection, it will be received for the record.

Mr. STEED. I suggest that it be received for committee reference but not actually made a part of the record.

Mr. ROOSEVELT. The Chair accepts that amendment. It will be received for reference in the files of the committee but not included in the permanent record.

Mr. PRICHARD. I also have a statement in writing from Mrs. Adele Grayson which she has given me as the summation of her testimony.

Mr. ROOSEVELT. Without objection, it will be received for the record.

(The statement referred to follows:)

STATEMENT OF MRS. ADELE GRAYSON, CHAIRMAN, LOS ANGELES CITIZENS FOR CLEAN AIR

AIR POLLUTION, AN INTRODUCTORY COMMENT

The smog problem in Los Angeles is not, as so many people have been lead to believe, caused by "inversion," or climatic conditions. It is caused by air pollution. While this may seem a strange way of expressing the matter, the confusion, like the smog itself, is manmade. Simply stated, the air, or climate above Los Angeles is not to blame; it is what is being poured into the sky over us that is the primary culprit.

Pollutants that go into the air, or atmosphere, emanating from the smokestacks of oil refineries, powerplants, and factories or exhaust pipes from motor vehicles are trapped in the Los Angeles area by hills surrounding the Los Angeles area. The layer of warm air over the city prevents the upward circulation of the cooler air below, creating a stagnant atmospheric condition.

EFFECTS OF SMOG

At one time, "smog" was defined as being the combination of smoke and fog, and the term had essentially humorous connotations. However, since the war, smog has taken on an entirely new character in that it is frequently poisonous and noxious. There is more than a difference of degree between discomfort and danger. This is essentially the problem of smog. In addition, it can be easily verified that the smog problem is growing. There is more of it, and it is more poisonous every year. Even the air pollution control district says it will become worse.

Among the more severe effects of smog, the following can be counted as primary:

1. During periods of heavy smog the death rate rises sharply.

2. People with respiratory ailments live through periods of heavy smog with increasing difficulty. The strain on their health is such that their life expectancy is appreciably reduced, even if no death occurs immediately.

3. The history of disasters caused by air pollution in other cities, both in the United States and elsewhere, makes it evident that similar disasters are not only possible but probable in Los Angeles.

4. Crops, as well as humans, have been severely afflicted with smog. Fruits and vegetables, buds, leaves, and shoots have been seared by chemical-laden air.

5. Business in Los Angeles has suffered, particularly in the downtown area where smog attacks have frequently been so severe as to cause entire office buildings to shut down.

6. There was a day in October of 1954 when it almost became necessary to evacuate all of downtown Los Angeles. The concentration was so heavy that visibility at daylight was less than 100 feet. Only a later shift in the wind saved the city from virtual asphyxiation.

CAUSES OF SMOG

1. Although smoke and dust can be injurious to health, in the absence of harmful chemical content mixed with the smoke and dust, they cannot be regarded as truly dangerous to the community as a whole. It is the chemical compounds, using smoke and fog as a vehicle, that cause the crisis.

2. The vaporous and solid chemical compounds that, in part, create this serious health problem, and that are becoming a real menace are: Hydrocarbons and their oxidents, sulfur dioxide, nitrogen, lead.

3. These chemicals and their related chemicals emanate principally, if not entirely, from petroleum sources. They are:

Catalytic crackers used at oil refineries
Petro-chemical scavengers
Industrial plants using impure or low-grade fuels
Vehicles using gasoline
Vehicles using diesel oils
Normal evaporation of gasolines exposed to air
All improperly combusted fuels.

4. Methods presently used to refine oil into gasoline cause the emanation of hydrocarbons and their escape into the air. In the sunshine, they oxidize into irritants affecting eyes and mucous membranes. Research is still revealing further effects of these oxidents on humans.

5. Sulfur and its related chemicals are present in uniquely high amounts in California petroleum. This sulfur escapes into the air as a result of cracking methods from the oil refineries. Sulfur dioxide is known to have been one of the primary causes of deaths by air pollution in the Meuse Valley in Flanders, in the London disaster, and in the Donora and New Orleans disasters.

6. Automotive fuels are the chief sources of the lead and nitrogen we breathe on smoggy days. Lead (tetra-ethyl) is put into the gasoline as a detergent which flushes impurities, including sulfur, out of motors to prevent knocking. Now nitrogen ("TCP") has been added to get rid of the lead, so that our lungs are being assaulted by heavy daily doses of all these poisons.

7. There are three oil refineries in the United States that create high-octane gasolines without the harmful impurities that are present in all gasolines obtainable in this area. (These companies are: Sunoco, Gulf, and Amoco.)

8. It is interesting to note that the inventor of the new catalytic cracking process for refining oil into higher octane ratings warned that this process would result in serious air pollution. He also invented a control feature called the Houdry catalyst which would prevent air pollution, or at least reduce it to non-injurious levels. However, the California oil companies have not installed this device.

CONTROLS IN EFFECT

1. The air pollution control district was created by State legislation, and is under the authority of the Los Angeles Board of Supervisors.

2. The district is given the job of enforcement and the granting of permits to businesses engaged in manufacturing processes that may pollute the air.

3. The district has very probably done a reasonably good job of inspection. However, records of proceedings in important cases are not made available to the public. There is reason to suspect that the testing and evaluation of tests has been highly inadequate, thus in many cases frustrating the proper implementation of control.

4. One of the most difficult aspects of smog control is that the original laws left several loopholes through which the smog continues to roll unimpeded. Variances are granted on the excuse that smog control equipment is not available, or that the company cannot afford to install it at that point, or that the situation will be corrected in due time, etc., etc. This has resulted in the destruction of public confidence in enforcement, as well as a deterioration of morale among the men in the lower echelons. Large manufacturers have been protected, whereas owners

of automobiles have been blamed with being the chief source of the pollutants.

5. A proper chain of command, with the power to handle a real crisis, is not in existence. Predictions have been made by responsible people that in the event of another period of excessive concentration, relief measures will be caught in a paralysis of inaction, ineffectuality, and confusion. There is further the problem that the so-called Smog Red alert is defined by the control district as being a time when smog is reaching a concentration not injurious to humans but needful of watching. Again, reliable authorities at the University of Southern California and the University of California, Los Angeles, have repeatedly made the comment that the control district underestimates the injurious effect of Smog Red concentrations.

SUMMARY

Returning to the original comment on smog made at the beginning of this discussion, it is evident that the present machinery is totally inadequate for arriving at a solution of the smog problem. When faced with the fact, the control district, along with the city council, manages to evade the issue by hopelessly confusing the public on the causes of smog, thereby making the public believe there is no remedy. Of course, there are remedies, and they are well within the possibility of this city's solution.

The first step is to face squarely the causes of smog. The second step is to formulate laws designed to attack these causes effectively and forcefully. The third step is to set up an aggressive body with full power to see that these laws are enforced.

It might seem that this is too simple, but it must be remembered that Los Angeles is not the first city to have faced smog. Temperature inversion, and peculiarities of the climate are not the issue. The issue is how to prevent noxious chemicals from escaping into the atmosphere over Los Angeles.

Pittsburgh and St. Louis both had this problem at one time. They no longer have it * * *. Not by accident, but by intent. Smog is conquerable. It is more easily vanquished than public apathy, indifference, and confusion.

As the trees, fruits, flowers, and vines wither and die now, so shall the people of Los Angeles sicken and be struck down by the air they breathe.

Only an informed and aroused citizenry can compel the proper authorities to take action leading to the conclusive eradication of the smog menace.

Mr. PRICHARD. She is the lady who conducted the picketing yesterday, I understand.

Dr. Daugherty asked that I present to the committee a copy of a paper he wrote regarding air pollution.

Mr. ROOSEVELT. Without objection, it will be received.

(The statement referred to follows:)

AIR POLLUTION FACTS AND FALLACIES

By Robert L. Daugherty, professor of mechanical engineering, California Institute of Technology, and member, hearing board, air-pollution-control district

I wish to propound two questions to everyone who is interested in the reduction or elimination of air pollution in the Los Angeles area. I ask these questions in all seriousness, as I have often asked them of myself, and I wish I knew the answers.

The first question is this: "I you wished to eliminate or at least reduce the smog, and if you were an absolute dictator with all of the power and authority of Julius Caesar, Napoleon, Hitler, Mussolini, and Stalin all rolled into one, and you were bound by no laws or economic considerations, just what specific things would you do?" (I assume that even an absolute dictator would not wish to paralyze the community nor cause the removal from the area of a large proportion of the population.)

The second question is more realistic. It is this:

"If you alone possessed all of the power and authority of the county board of supervisors and the air-pollution-control officer together, and did not require the consent of anyone for any orders you might give or any action you might take, but you did have to keep within the limits of the laws of the State and the Nation, what would you then do beyond what is now being done?"

Many glib statements have been made by various persons claiming that it is necessary only to enforce the law, but the problem is not that simple. It is

like saying that the way to eliminate traffic congestion on the freeways is to enforce the law. But we all know there is no law that could reduce traffic jams.

POPULATION ADDS SMOG SOURCES

There is a similar situation in regard to smog. A constant influx of new residents into this area is causing a corresponding increase in air pollution from all sources. At the present time there is no law that can be applied to many of these.

One example is the exhaust from automobiles, which is probably the biggest single factor in air pollution. There is no law to be applied and there can be no law until a remedy has been found. This problem is being actively worked upon, but while there are some promising ideas, there is as yet no practical device that can prevent the emission of unconsumed hydrocarbons, which are the primary source of the eye-smarting elements in the air. We are not concerned with smoking exhausts from engines with worn piston rings, but rather with the invisible exhausts from engines in good condition.

The consumption of gasoline in the Los Angeles area is steadily increasing and is approaching 5 million gallons per day. The computed amount of unconsumed hydrocarbons, or gasoline vapor, in the exhausts of all cars driven in the county depends upon the assumption made about typical driving conditions, but it is generally estimated that the total at present is about 1,100 tons per day. Of this, about 780 tons per day are of the types reported to be especially capable of producing smog. The presence of unconsumed hydrocarbons in the exhaust gases of automobiles is not a result of defects in engine or carburetor design. Nor can one blame the fuel used. The cause may be found in certain fundamental principles of combustion. For the complete combustion of any fuel, either in an engine or elsewhere, there are certain conditions that must be met. Among these necessary factors are: an adequate supply of air, complete mixing of the air and fuel, a sufficiently high temperature, and sufficient time for the reaction to be completed.

It is impossible to fulfill all of these conditions in the automobile engine. For example, it is necessary to have a very rapid burning because of the short time available. But in an engine, maximum flame velocity is obtained when the air supply is about 10 percent less than is theoretically necessary for complete combustion. Also, the engine performs at its best when the carburetor is adjusted to give about this same proportion of air. Obviously, no fuel can be burned completely when there is a deficiency of air; hence it is inevitable that there will be unburned fuel in the exhaust.

It is also a fact that combustion is especially poor during deceleration and the exhaust gases are most objectionable during this operation. Efforts are now being made to add some practical device which will cut off the flow of gasoline during deceleration and yet not permit the engine to stop.

CATALYTIC CRACKING NOT CAUSE

The contention of some persons that air pollution is due to present day catalytically cracked gasoline is a complete fallacy. Tests made in the east with catalytically cracked gasoline, prewar gasoline cracked by the old thermal process, and propane and butane gas, show clearly that the composition of the exhaust gas is practically the same regardless of the fuel used. Whatever type the fuel may be when it enters the engine, that fuel undergoes what amounts to a cracking process as it is consumed. For the engine, with its high pressure and high temperature, is in itself an effective cracking device.

Thus we see that all gasolines, regardless of refining method employed, are capable of forming smog. It is not the gasoline additives, but the gasoline vapor itself, that combines with nitrogen oxides under the influence of sunlight to form smog. Obviously then, what is needed to reduce the automobile's contribution to smog, is a device that would reduce the amount of gasoline vapor that is left unburned, and that enters the air from the exhaust. Every effort is being made in this direction.

WHAT WOULD YOU DO?

In the face of these facts, again I ask the question: what would you do, if you had the power, to eliminate air pollution, beyond what is now being done?

The motor vehicle is not the only source of air pollution, but it is a major one. Also, the contribution from exhaust gases is steadily increasing and tends to offset the gains that are being made in other fields.

In the past 5 years, for instance, the oil refineries have spent $24 million for control equipment, reducing their emissions of hydrocarbons to about 190 tons per day. Thus at present, the hydrocarbons in automobile exhaust gases far exceed those from the refineries and, unfortunately, until a completely effective and practical control device for the automobile is developed, we cannot stop the pollution that is coming from our streets and highways.

In the reduction of air pollution, the only fields in which laws can be applied at present are those of industry and incineration. I am much impressed by the efforts industry is making to remedy the problem. If, despite these efforts, complete control of all industrial sources has not been achieved, it is because technological knowledge is insufficient at present to provide 100 percent control methods for these sources. Where effective controls are available, enforcement has seen to it that these controls have been installed. I know of several firms that have had to cease operations because they were unable to finance the control equipment required. Control of industrial air pollution has not suffered for lack of adequate law enforcement.

IT TAKES MORE THAN MONEY

The reduction of air pollution is not a mere matter of spending money. It is necessary to know what to spend the money for and it is a fact that considerable money has been spent at times without any tangible benefit. It is often necessary to do considerable research before a successful means of control can be found.

In the industrial field, where laws can be applied and enforced, both the total and the percentage contribution to air pollution is constantly decreasing, while that from automobile exhaust is constantly increasing.

The other field in which a law can be applied is to the single-chamber or backyard type of incinerator. A few years ago, there were 500,000 of these in this area. It is estimated that there are now over 1,500,000 of them, and like the automobile, they are constantly increasing in number. I heard of a recent housing project with 2,000 new homes and 2,000 new incenerators.

It is reported that 9,000 tons of rubbish are burned in such devices every day. They are the chief source of smoke and play a most important part in the reduction of visibility. The film entitled "The City That Disappeared" shows this most clearly. A motion-picture camera was set up about daybreak overlooking Pasadena. Every few minutes a frame would be exposed so that on the screen one would see in a short time what took place over several hours.

At first one could see the entire city and identify various large buildings and church steeples. Presently a little column of smoke would be seen ascending from some incinerator. One could almost tell its location. Then later, one column after another would arise until finally the entire city was hidden by the smoke.

In addition to smoke, these incinerators discharge fly ash and other solids, as well as invisible gases. Even the most minute particles from this source not only decrease the visibility, but also add to the irritating substances in the air.

INDIVIDUAL SACRIFICE REQUIRED

The public demands that air pollution be reduced and yet when an attempt is made to eliminate these single-chamber backyard incinerators, a large segment of the population at once protests. It is very comforting to place all blame for air pollution upon industry, but when it comes to the individual's incinerator, that is another matter.

Suggestions are even being made that the question of eliminating backyard incinerators be placed upon the ballot. That is the height of absurdity. A scientific fact cannot be decided by a popular vote.

A certain political group has a slogan which is: "We believe smog will disappear when the public welfare is put above private interest." The question may well be asked if the private incinerator is not being put above public welfare. Aside from this, I would like to know whether any specific cases could be named where private interest has been put above public welfare. This slogan is one of those generalities which have no meaning.

CONCLUSION

In summary, the three sources of air pollution are automobiles, industry, and incinerators. As to the first the air pollution control district is working in its auto exhaust laboratory and in cooperation with the automobile industry, as well

as with private research agencies, toward a feasible solution. Industry is complying with the law as fast as it can find the proper means to do so. The general public so far has been reluctant to do its part in eliminating backyard burning. But abolition of incinerators is scheduled for September 30, 1957—a 2-year extension from September 30, 1955, to allow cities to establish adequate rubbish collection and disposal facilities.

Replacing the present board of county supervisors or any member thereof will produce no beneficial results in the reduction of air pollution. This is not a political problem and attempts to make a political issue out of it merely serve to undermine the efforts that are being made both by public officials and industry. It is necessary for the public to support the supervisors and the air pollution control officer in their efforts. Carping criticism, without cooperation, will result only in a delay of the eventual solution to the smog problem.

The situation is reminiscent of a story related about Calvin Coolidge. It is said that when he came home from church one Sunday his wife asked him the subject of the sermon. "Sin," he replied. "And," inquired his wife, "What did the minister say about it?" Answered Coolidge: "He was against it."

That is a platform on which all of us can get together concerning air pollution. All of us, elected and appointed officials, industry and private citizens alike—are against it. But we must take intelligent, workable steps if it is to be conquered.

Mr. PRICHARD. This paper will supplement his testimony.

Then I believe there should be included for reference purposes a copy of the Information Kit of the Air Pollution Control District, which contains a number of documents summarizing conclusions arrived at by the air pollution control district.

Mr. ROOSEVELT. Without objection, it will be received and kept on file by the committee for reference purposes.

Mr. PRICHARD. That is all, Mr. Chairman.

Mr. ROOSEVELT. Thank you, Mr. Prichard, very much.

Now, I would like to emphasize on behalf of the committee the following points:

One, that there is no question in our minds that smog has produced and will continue to produce as long as it exists a very serious economic and financial loss to small business in the area, and this loss is further translated into general economic loss for the entire community.

Two, that we are in agreement that the smog problem is a complicated and constantly varying problem and that in all likelihood it will be with us for a considerable and undeterminable period of time, and that it may well be complicated by new developments not yet part of the economic structure of the area.

We believe that because of the economic harm and the health harm, regardless of what degree the health harm may be assessed as having, that there is justification and demand for an immediate all-out effort to perfect control devices on the uncontrolled part of present emission.

Four, that from testimony given to us, we feel that this in particular should be aimed at automobile or transportation emissions and local governmental units which contribute, I believe, nitrous oxides and other contaminants to the total overall picture.

Five, that we believe that there is an immediate need for much greater State and local cooperation and coordination, starting on the State level and going on down through the local level to coordinate all aspects of research and also of enforcement, and that in order to properly assess the needed Federal contribution to these fields, that proper State and local officials are required to immediately get to work on the problem.

Six, we would emphasize that in our view as of this time we feel that it should be made very clear to the public that there is no such thing as any quick and complete cure to the problem, and that those who would even intimate such is possible do the community a disservice, and lastly, the committee wishes to assure the community of our appreciation for the cooperation which we have had and to assure the community that we will do everything possible to assimilate the mass of material which has reached us and to translate it into specific recommendations to the executive branch of the Government and where we feel it may be needed to translate it into legislative recommendations through the proper committees of the House.

Ladies and gentlemen, we want to thank you for your great patience and forebearance and the committee will now stand adjourned subject to the call of the Chair.

(Whereupon, at 5 p. m., the subcommittee adjourned, subject to the call of the Chair.)

APPENDIX

MAY 29, 1956.

Hon. JAMES ROOSEVELT,
Chairman of Subcommittee No. 5,
House of Representatives, Washington, D. C.

DEAR CONGRESSMAN: I had the pleasure of attending the congressional hearings on smog May 18, 1956, at the Federal Building in Los Angeles, Calif. Because of the limited time available for the witnesses called upon to testify, Mr. Warren H. Biscailuz and Congressman Sheehan suggested that I mail you a statement, to be inserted into your records.

I shall accordingly proceed with the same procedures which were used at your hearings.

EXPERT QUALIFICATIONS

I am a doctor in chemistry and physics, graduated from the University of Rome, Italy, in 1922. I took post-graduate work at the Institut Philotecnique, Brussels, Belgium, and graduated as chemical engineer in 1924. Since then I have been active in chemical-physical research and as a consultant in engineering research in Europe and in this country.

I was president of the Radium-Chema Corporation of America, 238 Madison Avenue, New York City, pioneers in radium, microtherapy, and the originators of gamma-rays inspections of metals for industrial purposes.

I have been a consultant for many large concerns in this country and abroad since I became an American citizen in 1936, acting as prime contractor in research work for the Untied States Air Forces on automatic weather stations and electronic devices, as consultant for the guided missiles program of Douglas Aircraft, mainly in instrumentation, et cetera. I lectured in nuclear physics and cosmic rays in South America and in the United States.

I am head of the radiological division of the Beverly Hills Civil Defense and director of engineering research with the James R. Keyes Co., of San Francisco and Los Angeles. I have also been certified through examination by the Los Angeles Civil Service Commission as physicist-air pollution. My firm is engaged in consulting engineering activities in air pollution abatement on the west coast.

AIR POLLUTION ABATEMENT AND CONTROL IN THE LOS ANGELES BASIN

I will try in my statement not to be repetitious of any of the expert testimony which was presented at the hearing.

With much of the testimony on the problem of smog I concur fully; with some of it I disagree, and I believe that an honest difference of opinion may help to put some light on the local and national problem of smog.

We have heard very confusing and contradictory testimony on the results of the abatement and control of smog, by Mr. Will, chief county officer, who painted an extremely rosy picture of accomplishments by the air pollution control district, later on contradicted by Mr. Griswold and the staff, Dr. Chambers, Mr. Graybough, and Captain Fuller, of the enforcement division of the APCD.

I wish to point out at this time that, with the exception of the few representatives of small businesses who discussed the damaging effects of smog to their businesses, all the other expert testimony was from persons directly connected with the APCD or the beneficiaries of grants from them. It was surprising that not one of the private engineering firms interested in the abatement of smog and not one of the equipment manufacturers of the devices to control smog appeared at all. Nothing to say, or were they afraid to encounter the disfavor of the APCD?

So far, we all agree that the pollution in the air has to be controlled at its manmade sources, therefore the most important thing is to know the quality of pollution emitted daily and then the chemical and physical quality of the emissions.

If we measure it in tons, the facts are the following:

As per May 10, 1955, from the records of the air pollution district and air pollution foundation, we see that 1,100 tons of daily pollution were eliminated during the period of 1948 to May 10, 1955, at its source. This figure refers to control as applied to the industry, to some incinerators and none to the automotive vehicles. Apart from the 1,100 tons eliminated as of May 10, 1955, the official figures from the agencies mentioned are that 3,700 tons of pollution were still ejected into the air daily. Obviously, the goal is to eliminate all of this pollution but, this probably being impossible, the joint control efforts should try to eliminate at least 50 or 60 or 90 percent of it.

Mr. Griswold testified that as of May 15, 1956, the APCD had eliminated a total of 1,500 tons. That is, 400 tons more during 1956 to be added to the 1,100 tons from 1948 to 1955. However, he also said that there were 5,600 tons of daily pollution which were emitted in this year period and therefore is 1,500 tons are subtracted from the 5,600 tons, this leaves a net daily pollution now of 4,100 tons. Comparing the figures from May 10, 1955, to May 18, 1956, then the net daily pollution in the Los Angeles Basin has increased 400 tons.

I believe that the Federal Government, of the State, and the counties should insist on the weight estimates of daily pollution because this is the only way to actually measure progress or regress in the fight for the control of smog in the Los Angeles Basin or anywhere else in the country.

We have been told, at the congressional hearings, that no effective device has been perfected to control the automotive exhausts as yet, and also that this phase of pollution represents 60 percent of the source of air pollution. If a device is developed, it will take at least 3 more years before it will be installed on new and old auto vehicles. We have been told also that the incinerators—1½ million of them—will be eliminated by some pickup and disposal method when this service is organized, possibly by the end of 1957, and that the incinerators represent about 15 percent of the total air pollution.

In line with this testimony then the total air pollution of the 15,000 industries, refineries, utilities, et cetera, amounts to only the remaining 25 percent. (Industry, 25 percent; automotive, 60 percent; incinerators, 15 percent; total, 100 percent.) It follows, then, that the APCD multimillion-dollar project, planning, engineering, research, advertising, and enforcement organization is only nibbling at the 25 percent of air pollution of which only a small part, the one represented by small industries, might effectively be controlled, while the major offenders have been granted variances after variances for the "study" of their control problems. (See the Edison Co. etc.)

Of course, I could take exception to the APCD statements that the automotive vehicles represent 60 percent of the total air pollution by quoting their own figures. They say that there are 2½ million automotive vehicles in the Los Angeles Basin and that each one contributes 1 pound of pollution per day. Well, 2½ million pounds equals 1,250 tons, which is only 33 percent of 4,100 tons of daily pollution. Is it not?

The doubletalk and the contradictory figures they are issuing in their own literature is as amazing and confusing as their claimed results and promises of action. What we heard of the biological and medical aspects and effects of the smog on vegetation and animals (we, included) especially by the medical "authorities" was just as much contradictory and at times tragic and hilarious.

THE REQUEST FOR MORE MONEY FOR RESEARCH

This word "research" is a very elastic word, highly sounding, to justify to the layman colossal expenditures, resulting too often, if not closely examined, in waste of money and manpower. What the APCD and the Air Pollution Foundation already know as to the chemical and physical characteristics of smog is more than ample to apply control devices for its abatement.

How could they logically enforce the controls if they did not know what and how to control? However, the APCD, to perfect and aggrandize its bureaucratic tentacles and status, uses this word "research" for its endless quest of funds and to establish its everlasting permanency.

Mr. Griswold testified also that because the air-pollution problem is greater in the Los Angeles Basin and worse than in any other part of the United States,

it is only fair that most of the funds for smog from governmental agencies should be contributed to the APCD for their "research."

The cynicism of this paradox is simply appalling. Just because of omission and dereliction of duty the successive administrations and officials in the Los Angeles Basin have permitted this condition to develop to such distressing proportions, now they expect a vote of confidence and a blank check. They have allowed the pestilence to form and grow and now want to derive from it profits.

Before pouring in more governmental and taxpayers' money, should we not scrutinize more closely the APCD's administrative and research setup? Is it any better than in the past? Will the taxpayers ever wake up or will they ever have a chance, through their Congressmen, assemblymen, and county supervisors, to reduce waste, political footballs, patronage, and doubletalk at the various county, State, and governmental levels?

Our representatives do not need to be steamrolled by "pseudo-scientists" to see through what has been going on in the smog abatement program, but can they help us?

History tells us that dictatorships fall because of the tyranny they institute and that democracies decline and fall because of corruption and demagoguery. Should not we be alert to our own pitfalls?

Sincerely,

Dr. ALEXIS PANTALEONI.

LOS ANGELES, *May 18, 1953.*

Re smog and future growth.

Congressman JAMES ROOSEVELT,
Small Business Committee.

SIRS: "Smog," a made word actually is a combination of poisonous gases, contaminants and fumes that pollute the atmosphere and cause illness, death, and destruction in varying amounts. Briefly, according to one Mr. Phillips, an engineer and chemist who was employed by a large oil company until he began a very exhaustive and authoritative research thoroughly documented and supported by facts, graphs, statistics, etc., for a period of 8 years. His findings are corroborated by the Los Angeles County Medical Commission on Smog.

He contends and proves that the ethyl-lead content of certain gasoline from autos is the prime source. It is interesting to note that the inventor of ethyl gas died insane and in agony from the "Frankenstein" invention he developed. The poisonous effects of lead inhaled, touched, or contacted, is indicated by the warnings of the manufacturers. The second largest offender is the cracking plants of the refineries. The inventor of the Kellogg system warned of its killing effects unless impurities were removed from the stacks and the gasoline itself. TCP recently developed by Shell Oil Co., creates nitrogenous gases that are poisonous and toxic. Mr. Phillips should be interviewed by the committee as should the chairman of the antismog committee, the mayor of Pasadena.

The criminal elements exposed by recent Los Angeles hearings on rubbish and the efforts of the oil companies and other powerful lobbying interests, some of whom are under investigation by Senator McClellan for offering brides to political parties and Senators, should be questioned. City Councilman Debs made a survey of Marcus Hook, Pa., and his testimony as indicated by his report to the council should be valuable.

Marcus Hook, where the problem was very severe, removed smog in a very few months.

As to the intervention of Federal authorities, the United States Public Health Service should be authorized to make some remedial prosecutions under the emergency and urgency of the matter.

Finally, I am attaching hereto a copy of a recent issue of Look magazine with an article by one of its staff. Such deleterious propaganda can only be detrimental to the future growth and progress of our Los Angeles County community. Local authorities for some mysterious reasons have shown little regard for the health and comfort of our citizens. Persistent rumors of opposition, resistance, and even pressure on our officials are indicated by the recent test case of the Union Oil Co. Favoritism to these same companies was indicated by a recent hearing on hydrocarbons held in Los Angeles by a committee of the State legislature.

Respectfully submitted.

IRVING BENESCH.

AMALGAMATED CLOTHING WORKERS OF AMERICA,
Los Angeles, Calif., February 2, 1956.

Congressman JAMES ROOSEVELT,
Chairman, Small Business Committee,
House of Representative, Washington, D. C.

DEAR CONGRESSMAN ROOSEVELT: As you know, during the past several years, smog in southern California has become an increasingly serious problem. The fact is very disturbing to the community at large, but the very bad effect it has had on the earnings of workers employed in various industries makes it even more important.

Our experience has shown that on days when smog is bad, workers employed in production of men's clothing and the allied industries are unable to continue on their jobs. Since these industries are mainly paid on a piecework basis, this means a loss of man-hours and earnings for our members. There have even been occasions when whole plants have had to shut down due to the smog.

The men's clothing and allied industries are particularly affected because our workers do close sewing jobs and any eye irritation, such as tearing or swelling, interferes with the possibility of working.

The needle trades have, in the past 15-year period, been an expanding industry in this area. We are concerned with the smog problem in this connection because we believe that the production of clothing and sportswear can continue to increase but we are now fearful that owners will be reluctant to expand their operations or open new plants if the smog continues to be a production hazard. We are also concerned lest employers begin to seek plants outside of the city beyond the smog belt. This would obviously be ruinous to our members.

I am sure you can see that smog is a serious matter for members of the Amalgamated Clothing Workers of America and for the industry in which they are employed. I trust that your committee will do everything in its power to help alleviate the problems.

Sincerely yours,

JEROME POSNER, *Manager.*

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